

<b>15AVP201 /</b>	<b>AMRITA VALUES PROGRAMME I/</b>	<b>1 0 0 1</b>
<b>15AVP211</b>	<b>AMRITA VALUES PROGRAMME II</b>	<b>1 0 0 1</b>

Amrita University's Amrita Values Programme (AVP) is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Students shall have to register for any two of the following courses, one each in the third and the fourth semesters, which may be offered by the respective school during the concerned semester.

#### **Courses offered under the framework of Amrita Values Programmes I and II**

##### **Message from Amma's Life for the Modern World**

Amma's messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma's guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

##### **Lessons from the Ramayana**

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

##### **Lessons from the Mahabharata**

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

##### **Lessons from the Upanishads**

Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The

Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, Satyakama Jabala, Aruni, Shvetaketu.

##### **Message of the Bhagavad Gita**

Introduction to Bhagavad Gita – Brief storyline of Mahabharata - Context of Kurukshetra War – The anguish of Arjuna – Counsel by Sri. Krishna – Key teachings of the Bhagavad Gita – Karma Yoga, Jnana Yoga and Bhakti Yoga - Theory of Karma and Reincarnation – Concept of Dharma – Concept of Avatar - Relevance of Mahabharata for modern times.

##### **Life and Message of Swami Vivekananda**

Brief Sketch of Swami Vivekananda's Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji's life.

##### **Life and Teachings of Spiritual Masters India**

Sri Rama, Sri Krishna, Sri Buddha, Adi Shankaracharya, Sri Ramakrishna Paramahansa, Swami Vivekananda, Sri Ramana Maharshi, Mata Amritanandamayi Devi.

##### **Insights into Indian Arts and Literature**

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

##### **Yoga and Meditation**

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali's Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

##### **Kerala Mural Art and Painting**

Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this

form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

### Course on Organic Farming and Sustainability

Organic farming is emerging as an important segment of human sustainability and healthy life. 'Haritamritam' is an attempt to empower the youth with basic skills in tradition of organic farming and to revive the culture of growing vegetables that one consumes, without using chemicals and pesticides. Growth of Agriculture through such positive initiatives will go a long way in nation development. In Amma's words "it is a big step in restoring the lost harmony of nature".

### Benefits of Indian Medicinal Systems

Indian medicinal systems are one of the most ancient in the world. Even today society continues to derive enormous benefits from the wealth of knowledge in Ayurveda of which is recognised as a viable and sustainable medicinal tradition. This course will expose students to the fundamental principles and philosophy of Ayurveda and other Indian medicinal traditions.

### Traditional Fine Arts of India

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is 'Unity in Diversity' and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

### Science of Worship in India

Indian mode of worship is unique among the world civilisations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realisation of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

15CHY100

CHEMISTRY

3 0 0 3

#### Unit 1

Chemical Bonding

Review of orbital concept and electronic configuration, electrovalency and ionic

bond formation, ionic compounds and their properties, lattice energy, solvation enthalpy and solubility of ionic compounds, covalent bond, covalency, orbital theory of covalency - sigma and pi bonds - formation of covalent compounds and their properties. Hybridization and geometry of covalent molecules - VSEPR theory - polar and non-polar covalent bonds, polarization of covalent bond - polarizing power, polarisability of ions and Fajan's rule, dipole moment, percentage ionic character from dipole moment, dipole moment and structure of molecules - coordinate covalent compounds and their characteristics, molecular orbital theory for H<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub> and CO, metallic bond - free electron, valence bond and band theories, weak chemical bonds – inter and intra molecular hydrogen bond - van der Waals forces.

#### Unit 2

Thermodynamic Parameters

Stoichiometry - mole concept, significance of balanced chemical equation - simple calculations - Conditions for occurrence of chemical reactions - enthalpy, entropy and free changes - spontaneity – Thermochemistry - heats of reactions - (formation, combustion, neutralization) - specific heats - variation of enthalpy change with temperature - Kirchhoff' relation (integrated form) - bond enthalpy and bond order - Problems based on the above.

Kinetics

Review of molecularity and order of a reaction, rate law expression and rate constant - first, second, third and zero order reactions, pseudo-first order reactions (pseudo-unimolecular reactions) - complex reactions - equilibrium and steady state approximations - mechanism of these reactions - effect of temperature on reaction rates - Arrhenius equation and its significance, Michaelis Menden kinetics-enzyme catalysis.

#### Unit 3

Electrochemistry

Electrolytes - strong and weak, dilution law, Debye-Huckel theory, faraday's laws, origin of potential, single electrode potential, electrochemical series, electrochemical cells, Nernst equation and its application, reference electrodes- SHE, Ag/AgCl, Calomel.

Photochemistry

Photochemistry, laws of photochemistry - Stark-Einstein law, Beer-Lamberts law, quantum efficiency-determination, photochemical processes - Jablonsky diagram, internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo sensitization, photo polymerization.

**REFERENCE BOOKS**

*Physical chemistry, Puri and Sharma*

*Inorganic chemistry, Puri and Sharma*

**15CHY181****CHEMISTRY LAB.****0 0 2 1**

1. Acid base titration (double titration)
2. Complexometric titration (double titration)
3. Redox (permanganimetry) titration (double titration)
4. Conductometric titration
5. Potentiometric titration
6. Ester hydrolysis

**15CHY231****ADVANCED POLYMER CHEMISTRY****3 0 0 3****Unit 1**

Newer Polymers and Polymerizations: Polymeric Liquid Crystals - Inorganic and Organometallic polymers - Synthesis and reactions of Phosphorus - Nitrogen polymers - Boron - Silicone polymers. Cyclisation versus Linear Polymerization - Molecular weight control in linear polymerization - Molecular weight distribution in linear polymerization - Molecular weight distributions in nonlinear polymerization - Multichain Polymerization - Metallocene Polymerization.

**Unit 2**

Solid-state irradiation polymerization - Atom transfer radical polymerization - Plasma Polymerization - Zwitterionic Polymerization - Isomerization polymerization - Polymer supported solid phase reactions - Merrifield method.

Polymer degradation and stabilization: Mechanism of different types of degradation - Commonly used antidegradants and the mechanism of their stabilization.

**Unit 3**

Polymer solutions: Criteria for solubility - Heat of Dissolution and Solubility parameters - Conformation of polymer chains in solutions - Nature of polymer molecules in solution - Size and shape of macromolecules in solution - Thermodynamics of polymer solutions - Phase equilibria - Entropy and heats of mixing of polymer solutions - Effect of molecular weight on solubility - Solubility of crystalline and amorphous polymers - Flory Huggins theory of polymer solution, Equation of state theory, Flory Krigbaum theory and cluster type theory - Viscosity of dilute polymer solutions.

**TEXTBOOKS:**

1. George Odian, "Principles of Polymerization", John Wiley & Sons Inc., New York, (1991).
2. Malcolm P. Stevens, "Polymer Chemistry", Oxford University Press, New York, (1999).

**REFERENCES:**

1. Harry R Allcock and Frederick W Lampe, "Contemporary Polymer Chemistry", 2nd edition, Prentice Hall, Inc., New Jersey, (1990).
2. Charles E Carraher, Jr., "Polymer Chemistry", 5th edition, Marcel Dekker Inc., New York, (2000).
3. Jayadev Sreedhar and Govariker, "Polymer Chemistry".

**15CHY232****BIOMATERIALS SCIENCE****3 0 0 3****Unit 1**

Introduction: Bulk properties, Surface properties and characterization - polymers, silicone biomaterials, medical fibres and biotextiles - Smart polymers - bioresorbable and bioerodible materials - natural materials, metals and ceramics - physicochemical surface modification.

Biocompatibility concepts: Introduction to biocompatibility - cell material interaction - types of materials - toxic, inert, bioactive - long term effects of materials within the body - cell response.

**Unit 2**

Chemical and biochemical degradation of polymers - degradation of metals and ceramics - calcification of biomaterials.

Host reactions and their evaluation: Inflammation and foreign body response - adaptive immunity - systemic toxicity and hypersensitivity - blood coagulation and blood materials interactions - device related infections.

**Unit 3**

Biological testing of biomaterials: Invitro and invivo assessment of tissue compatibility - evaluation of blood materials interaction - microscopy in biomaterials.

Practical aspects of biomaterials: Bioelectrodes, biomedical sensors and biosensors - sterilization of implants - implant failure - implant retrieval and evaluation - legal aspects, ethical issues and regulation aspects.

**TEXTBOOK:**

Buddy D Ratner, Allan S Hoffman, "Biomaterials Science - An introduction to materials in Medicine", Elsevier academic press, (2004).

**REFERENCES:**

1. Jonathan Black, "Biological Performance of Materials: Fundamentals of Biocompatibility", 4th edition, CRC Press, (2006).

2. John D. Enderle, Susan M. Blanchard, Joseph D. Bronzino, "Introduction to Biomedical Engineering", 2nd edition, Elsevier Academic Press, 2005.

**15CHY233 CATALYTIC CHEMISTRY 3 0 0 3**

**Unit 1**

Catalysis: Introduction, Industrial applications. Rates of reactions - equilibrium, energy of activation and the catalyst's role, Elementary reactions in catalytic transformations homogeneous and heterogeneous catalysis.

Catalysis in solutions: Acid-base catalysis - catalysis in the gas phase, catalysis in dilute aqueous solution, catalysis in concentrated strong acid solutions, catalysis by bases, catalysis by metal ions, catalysis by electron transfer, organometallic catalysis, catalysis in Ziegler Natta/Metallocene/Metathesis polymerization.

**Unit 2**

Catalysis by macromolecules, Phase transfer catalysis.

Catalysis by Enzymes: Introduction - kinetics of enzyme catalyzed reaction, catalysis through enzyme, organic catalysis, metalloenzyme catalysis, supported enzymes. Industrial applications of enzyme catalyst.

Catalysis by Polymers: Attachment of catalytic groups to polymer supports, Adsorption and the Kinetics of polymer-catalyzed reactions.

**Unit 3**

Catalysis in polymer gels, bifunctional and multifunctional catalysis, porous polymers, Applications of polymer catalysis.

Catalysis in Molecular scale cavities: Structures of crystalline solids, structure of Zeolites, catalysis by Zeolites, catalysis by Zeolites containing metal complexes and clusters. Catalysis on surfaces – surface catalysis, catalysis on metal surfaces.

**TEXTBOOKS:**

1. Bruce C Gates, "Catalytic Chemistry", John Wiley & Sons, Inc. USA, (1992).
2. Viswanathan B, Sivasankar S, Ramaswamy A V, "Catalysis, Principles and Applications", CRC Press, (2006).

**REFERENCES:**

1. James E House, "Principles of Chemical Kinetics", Academic Press, (2007).
2. Kuriacose J C, "Catalysis", Macmillan India Limited, New Delhi, (1991).

**15CHY234 CHEMISTRY OF ADVANCED MATERIALS 3 0 0 3**

**Unit 1**

Chemistry of Engineering Plastics: Preparation, properties and applications of ABS, polycarbonates, epoxy resins - polyamides - Nylon and Kevlar.

Chemistry of Carbon nanotubes: Introduction, carbon nanotubes - fabrication, structure, electrical properties – vibrational properties – mechanical properties – applications of carbon nanotubes.

**Unit 2**

Electron transfer studies in salt based conductors and magnets: Introduction - definitions and units - ferromagnets and ferrimagnets. One-dimensional conductors - quasi one and two-dimensional super conductor. Fullerides - paramagnetic conductors and superconductors. Electron transfer salt based ferromagnets: nitroxide, metallocene and ferric magnet-based ferromagnets - weak ferro magnets. Nanopore containment of magnetic particles - nanocarbon ferromagnets.

**Unit 3**

Functional electro active polymers: Conjugated polymers - synthesis, processing and doping of conjugated polymers: polyacetylene, polyaniline, polythiophene, poly (p-phenylenevinylene) - ionically conducting polymers - applications of conjugated polymers. Semi-conducting, poly ferrocene - photo resist optical fibers and sensors, photo chromic & thermo chromic materials.

Photochemistry in Electronics: Laws of absorption - quantum efficiency and quantum yield - fluorescence and phosphorescence – photosensitization.

High energy materials: Preparation, properties and application of ammonium nitrate (AN), NH<sub>4</sub>NO<sub>3</sub>, ammonium perchlorate (AP), NH<sub>4</sub>ClO<sub>4</sub>, ammonium dinitramide (AND), NH<sub>4</sub>N(NO<sub>2</sub>)<sub>2</sub>, hydrazinium nitroformate (HNF), N<sub>2</sub>H<sub>5</sub>C(NO<sub>2</sub>)<sub>3</sub> etc.

**TEXTBOOKS:**

1. Van Vlack, Lawrence H, "Elements of Material Science and Engineering", 6th edition, New York Addison, Wesley, (1989).
2. Chawla S, "A Textbook of Engineering Chemistry", Dhanpat Rai & Co, Delhi, (2001).

**REFERENCES:**

1. Mark Ratner and Daniel Ratner, 'Nano technology - A gently introduction to the next big idea', Pearson Education, (2003).
2. Interrante L. V. and Hampden Smith M.J, 'Chemistry of Advanced Materials', Wiley-VCH, (1988).

**15CHY235 CHEMISTRY OF ENGINEERING MATERIALS 3 0 0 3****Unit 1**

Chemical materials in Electronics and Electrical Engineering: Structural correlation to behavior of conducting polymers, Semi-conducting polymers - properties of organic polymers containing metal groups such as poly ferrocene - optical fibers - definition, principle and structure - characteristics of optical fibre - photo resist optical fibre - advantages of optical fibre - liquid crystalline - piezo and pyroelectric polymers - magnetic materials, hard and soft magnets – sensors (voltametric).

Nanomaterials: Nanotubes and Nanowires, Carbon nanotubes, single walled and multiwalled, aligned carbon nanotubes, doping with boron – applications - Nanostructured polymers.

**Unit 2**

Chemical aspects in biotechnology - Enzymes and bio reactors - Biotechnological processes – Bio-sensors - glucose biosensors, bio-filters and bio-membranes – Bio-fertilizers, Bio-surfactants.

Chemistry of Engineering Plastics: Preparation, properties and applications of ABS, Polycarbonates, Epoxy resins - Polyamides - Nylon and Kevlar.

Photochemistry in Electronics: Photochemical reactions - laws of absorption (Groth's-Draper law - Stark-Einstein's law) - Quantum efficiency - photochemical decomposition of HI and HBr - and Quantum yield.

**Unit 3**

Florescence and Phosphorescence - chemiluminescence - photo sensitization.

Chemistry of Toxic Materials and Toxicology: Principles of Toxicology - Volatile poisons - Gases CO, hydrocyanic acid - H<sub>2</sub>S - PH<sub>3</sub> - CO<sub>2</sub> - SO<sub>x</sub> - NO<sub>x</sub> - Heavy metals - lead, arsenic, mercury, antimony, barium, bismuth, selenium, zinc, thallium - Pesticides - Food poisoning - Drug poisoning - barbiturates - narcotics - ergot - LSD - alkaloids - Radioactive Toxicology - Radiation hazards.

**TEXTBOOK:**

1. Kuriacose J C, Rajaram, "Chemistry in Engineering and Technology, Systematic Organic and Inorganic Chemistry and Chemistry of Materials (Vol 1 & 2)", Tata McGraw Hill Publishing Company Limited, 1999.

**REFERENCE:**

1. Van Vlack, Lawrence H, "Elements of Material Science and Engineering" (6th edition), New York Addison-Wesley, 1989.

**15CHY236 CHEMISTRY OF NANOMATERIALS 3 0 0 3****Unit 1**

Introduction: Introduction to Nanomaterials: Size dependence of properties - Surface to volume ratio and Quantum confinement. Microscopic techniques to study nano structures - SEM, AFM - TEM and STM - Raman spectroscopy.

Synthesis of Nanomaterials: Synthetic approaches: Colloidal Self-Assembly (Self-assembled monolayers - SAMs) and electrostatic self-assembly, electrochemical methods, sol-gel deposition.

**Unit 2**

Langmuir-Blodgett (LB) technique, chemical vapour deposition, plasma arcing and ball milling.

Carbon nanostructures: Carbon Clusters: Fullerenes, structure, synthesis, alkali doped C<sub>60</sub> - superconductivity in C<sub>60</sub>, applications of fullerenes. Carbon nanotubes: Classification, properties, synthesis, characterization, and potential applications, growth mechanism of carbon nanotubes.

Other Nanostructures: Quantum Dots: Preparation, properties and applications of Au, CdS and CdSe quantum dots,

**Unit 3**

Fabrication and applications of conducting polymer nanotubes, TiO<sub>2</sub> and metallic nanotubes.

Molecular Electronics and Machines: Molecular electronics: Working of Molecular and supramolecular switches, transistors and wires. Molecular machines: Working of Molecular motors, rotors, cars, elevators and valves.

**TEXTBOOKS:**

1. Charles P Poole Jr, Frank J Ovens, "Introduction to Nanotechnology", Wiley Interscience, (2003).
2. Alexei Nabok, "Organic and Inorganic Nanostructure", Artech House, Inc. (2005).
3. Peter J F Harris, "Carbon Nanotube Science: Synthesis, Properties and Applications", Cambridge University Press, (2009).
4. Balzani V, Credi A, Venturi M, "Molecular devices and machines - A journey in to the Nanoworld", Wiley VCH, (2003).

**REFERENCES:**

1. Rao C N R, Muller A, Cheetham A K (Eds.), "The Chemistry of Nanomaterials: Synthesis, Properties and Applications", WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, (2004).
2. Zhong Lin Wang, "Characterization of nanophase materials", Wiley VCH, (2000).
3. Massimiliano Di Ventra, Stephane Evoy, James R Heflin, "Introduction to nanoscale science and technology", Kluwer Academic Publishers, (2004).

- William A Goddard, III, Donald W Brenner, Sergey Edward Lyshevski and Gerald J. Lafrate, "Handbook of Nanoscience, Engineering, and Technology", CRC Press, (2003).
- Balzani V, Credi A, Venturi M, "Molecular devices and machines- A journey in to the Nanoworld" Wiley VCH (2003).
- Bharat Bhushan, "Hand book of Nanotechnology", Springer, (2004).

**15CHY237 CHEMISTRY OF TOXICOLOGY 3 0 0 3**

**Unit 1**

Introduction to Toxicology: Definition - scope - history - relationship to other sciences - dose-response relationship - sources of toxic compounds - Classes of Toxicants - broad overview of toxicant classes such as metals, agricultural chemicals, food additives - contaminants, toxins, solvents, drugs, and cosmetics - history, exposure route, and toxicity of the non-essential metals - cadmium, lead, and mercury - medical treatment of metal poisoning - classes of agricultural chemicals - Toxins - source, including microbial, fungal, algal, plant and animal - examples - Brief discussions - food additives and contaminants – solvents - therapeutic drugs - drugs of abuse - combustion products - cosmetics.

**Unit 2**

Exposure Classes, Toxicants in Air, Water, Soil, Domestic and Settings: Occupational Air, water and soil as primary media for human exposure to various classes of chemical toxicants in environmental, domestic, and occupational settings - historic and present status of air pollution and air quality - introduction to the major classes of soil and water pollutants - sources, exposure routes and potential adverse health effects - Classes of occupational toxicants - route of exposure and permissible levels - specific examples of concern.

**Unit 3**

Toxicant Analysis and Quality Assurance Principles: Introduction to procedures, principles and operation of analytical laboratories in toxicology. Summary of the general policies - analytical laboratory operation, analytical measurement systems, quality assurance (QA) - quality control (QC) procedures.

Environmental Risk Assessment: Environmental risk assessment procedures - particular environmental risk problem - appropriate endpoints - development of conceptual models, analyzing exposure – effects, information - characterizing exposure - ecological effects - management of risks.

Future Considerations for Environmental and Human Health: Changes in toxicology - evaluation of future risk assessment - more fundamental aspects of toxicology - in vivo and in vitro toxicity - biochemical toxicology - molecular toxicology - development of selective toxicants.

**TEXTBOOK:**

Ernest Hodgson, "Modern Toxicology", John Wiley & Sons, Inc., (2004).

**REFERENCES:**

- John Wright, "Environmental Chemistry", Routledge, (2003).
- A K DE, "Environmental Chemistry", New Age International, (2003).
- Fritz Helmet, "Environmental Chemistry", Sarup and sons (Delhi), (2003).

**15CHY238 COLLOIDAL AND INTERFACIAL CHEMISTRY 3 0 0 3**

**Unit 1**

Introduction to surfaces, interfaces and colloids: Molecular origin, Surface phenomena and structure of interfaces, Surfactants structure, colloids in action - shapes and size distribution, Types of interaction forces - Physical and Chemical interaction, Classification of physical forces - Vander Waals force, electrostatic forces.

The Adsorption Phenomena - Structure and Properties of Adsorption Layers at the Liquid-Gas Interface, Principles of adsorption thermodynamics, The Gibbs equation, Structure and properties of the adsorption layers at the air-water interface.

**Unit 2**

Interfaces between Condensed Phases - Wetting, The interfaces between condensed phases in two-component systems, Adsorption at interfaces between condensed phases.

Thermodynamics - Adsorption, energy consideration of physical adsorption vs chemisorptions, Gibbs adsorption equation, Langmuir isotherm, BET isotherm, adsorption at solid-liquid interfaces. Emulsions - formation and stability, HLB number, PIT (Phase Inversion Temperature) foams, aerosols, Microemulsions, vesicles, micelles and membranes - applications of various colloidal systems.

**Unit 3**

Characterization of Colloids, Rheological properties - Classification, Interfacial rheology, Interfacial tension, Electrochemistry of interfaces - Electric double layer. Stability of charge stabilized colloids, DLVO theory, Hamaker constant, Boltzmann distribution, Debye length, specific ion adsorption, stern layer, electrostatic, steric and electrosteric stabilization, zeta potential, surface tension, wetting and spreading, contact angle - Young's modulus, practical application - solid surfaces - surface mobility, characteristics and formation.

**TEXTBOOKS:**

- D. Myers, "Surfaces, Interfaces and Colloids: Principles and Applications", 2nd Edition, Wiley-VCH, 1999.

2. T. Cosgrove, "Colloid Science: Principles, Methods and Applications", 2nd Edition, Wiley-Blackwell, 2010.

**REFERENCES:**

1. P. C. Hiemenz and R. Rajagopalan (Editors), "Principles of Colloid and Surface Chemistry", 3rd Edition, Academic Press, New York, 1997.
2. J. W. Goodwin, "Colloids and Interfaces with Surfactants and Polymers", John-Wiley and Sons Ltd, 2004
3. William Harde, "Colloids and Interfaces in Life Sciences", Marshall Dekker Inc. 2003

### 15CHY239 COMPUTATIONAL CHEMISTRY AND MOLECULAR MODELLING 3 0 0 3

**Unit 1**

Introduction: Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born - Haber cycle – Energetic – kinetics - Principles of spectra.

Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.

Molecular mechanics: Basic theory - Harmonic oscillator – Parameterization - Energy equations - Principle of coupling - Matrix formalism for two masses - Hessian matrix - enthalpy of formation - enthalpy of reactions.

Introduction to Quantum mechanics - Schrodinger equation - Position and momentum - MO formation - Operators and the Hamiltonian operator - The quantum oscillator - Oscillator Eigen value problems - Quantum numbers - labeling of atomic electrons.

**Unit 2**

Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.

Huckel's MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel's theory and the LCAO approximation - Homogeneous simultaneous equations - Secular matrix - Jacobi method - Eigen vectors: Matrix as operator - Huckel's coefficient matrix - Wheeland's method - Hoffmann's EHT method - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

**Unit 3**

Self consistent fields: Elements of secular matrix - Variational calculations - Semi empirical methods - PPP self consistent field calculation - Slater determinants -

Hartree equation - Fock equation – Roothaan - Hall equation - Semi empirical models and approximations.

Ab-initio calculations: Gaussian implementations – Gamess - Thermodynamic functions - Koopman's theorem - Isodesmic reactions, DFT for larger molecules - Computer aided assignments/mini projects with softwares - Introduction to HPC in Chemical calculations.

Molecular modelling software engineering - Modeling of molecules and processes - Signals and signal processing in Chemistry - QSAR studies and generation of molecular descriptors - Applications of chemical data mining - Familiarization with open source softwares useful for molecular modeling - Introduction to molecular simulation - M.D. simulation.

**TEXTBOOKS:**

1. K. I. Ramachandran, G Deepa and K Namboori, "Computational Chemistry and Molecular Modeling - Principles and Applications", Springer-Verlag, Berlin, Heidelberg, 2008, ISBN-13 978-3-540-77302-3.
2. Donald W Rogers, "Computational Chemistry Using PC", Wiley, (2003).
3. Alan Hinchliffe, "Chemical Modeling from atoms to liquids", Wiley, (2005).

**REFERENCES:**

1. James B Forseman and Aeleen Frisch-Gaussian, "Exploring Chemistry with Electronic Structure Method", Inc., Pittsburgh, PA, 2nd edition, (2006).
2. A C Philips, "Introduction to Quantum mechanics", Wiley, (2003).
3. Wolfram Koch, Max C. Holthausen, "A Chemist's guide to Density Functional Theory", Wiley, VCH, 2nd edition, (2001).

### 15CHY241 ELECTROCHEMICAL ENERGY SYSTEMS AND PROCESSES 3 0 0 3

**Unit 1**

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

**Unit 2**

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken

their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air, zinc-silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: ARM (alkaline rechargeable manganese) cells, Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultra thin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

### Unit 3

Reserve batteries and Fuel cells: Reserve batteries - water activated, electrolyte activated and thermally activated batteries - remote activation - pyrotechnic materials. Fuel Cells: Principle, chemistry and functioning - carbon, hydrogen-oxygen, proton exchange membrane (PEM), direct methanol (DMFC), molten carbonate electrolyte (MCFC) fuel cells and outline of biochemical fuel cells.

Electrochemical Processes: Principle, process description, operating conditions, process sequence and applications of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electroless plating of nickel, copper and gold; Electropolishing of metals; Anodizing of aluminium; Electrochemical machining of metals and alloys.

#### TEXTBOOKS:

1. Derek Pletcher and Frank C. Walsh, "Industrial Electrochemistry", Blackie Academic and Professional, (1993).
2. Dell, Ronald M Rand, David A J, "Understanding Batteries", Royal Society of Chemistry, (2001).

#### REFERENCES:

1. Christopher M A, Brett, "Electrochemistry – Principles, Methods and Applications", Oxford University, (2004).
2. Watanabe T, "Nano-plating: microstructure control theory of plated film and data base of plated film microstructure", Elsevier, Oxford, UK (2004).
3. Kanani N, "Electroplating and electroless plating of copper and its alloy", ASM International, Metals Park, OH and Metal Finishing Publications, Stevenage, UK (2003).
4. Lindon David, "Handbook of Batteries", McGraw Hill, (2002).
5. Curtis, "Electroforming", London, (2004).
6. Rumyantsev E and Davydov A, "Electrochemical machining of metals", Mir, Moscow, (1989).

## 15CHY242

## ENVIRONMENTAL CHEMISTRY

3 0 0 3

### Unit 1

Air and air pollution (earth's atmosphere): Regions - ozone - CFC and other chemicals - catalytic decomposition of ozone - 'ozone hole' formation - Air pollution due to gas emission from industries - Atmospheric aerosols – dust, combustion products, aerosol concentration and lifetimes - Automobile exhausts, smog and effects - Acid rain - chemistry of acid rain, roll of meteorology, greenhouse gases and global warming - air pollution due to jet engines.

Water and water pollution (hydrosphere): Physical and chemical properties of water - microbiological processes - carbon, nitrogen cycles - Water pollution - polluting agents - indices of pollution, heavy metal pollution and toxicity - BOD and COD determination - suspended solids - determination of other ions by photometric methods - Chemistry of anaerobic process, use of Effective Microorganisms.

### Unit 2

Aerobic processes - wastewater treatment systems (brief description only) - anaerobic and aerobic - sewage treatment, primary, secondary and tertiary processes - water reuse and recycle. Eutrophication of lakes, nitrogen and phosphorus in effluents - Drinking water standards - sources - fluoride and arsenic in water, purification, sterilization - chemistry of chlorination - water purification for domestic use - reverse osmosis - nano filters and membranes.

Industrial Pollution and its control: Industrial pollution and waste waters from various types of industries - environmental pollution due to paper mills, textile mills etc., and its control. Solid waste disposal - methods - solid waste from mining and metal production and its disposal - Electrochemical treatment of pollution control, electro-coagulation and flocculation - Green chemical processes and green solvents - reaction conditions to control industrial pollution.

### Unit 3

Other types of pollution: Soil pollution - agricultural pollution - use of chemical fertilizers - Organic chemicals and environment, dioxins and furans - chemistry of some of the pesticides, insecticides and herbicides, ill effects due to uncontrolled use - Bulk storage of hazardous chemicals and disasters, Radioactive pollution, radiation units, sources - exposure and damage - safety standards - radioactive wastes and their disposal - Toxicological substances, testing of toxic substance, enzyme inhibition and biochemical effects of toxic chemicals on humans.

Sampling and Measurements of Pollutants: Sampling and analysis techniques of air pollutants (brief outline only) - analysis of particulate matter and lead - Sampling



and measurements of water pollutants - organic loadings, phosphates and nitrogen compounds - monitoring of water quality - water test kits, various analytical methods (brief outline only).

**TEXTBOOKS:**

1. Gary W. Van Loon and Stephen J. Duffy, "Environmental Chemistry", Oxford University Press, (2000).
2. Ajay Kumar Bhagi and G. R. Chatwal, "Environmental Chemistry", Himalaya Publishing House, (2003).

**REFERENCES:**

1. John Wright, "Environmental Chemistry", Routledge, (2003).
2. A K De, "Environmental Chemistry", New Age International, (2003).
3. Fritz Helmet, "Environmental Chemistry", Sarup and sons (Delhi), (2003).
4. Clair N Sawyer, Perry L McCarty and Gene F Parkin, "Chemistry for Environmental Engineering", McGraw Hill, (1994).
5. Jack Barrett, "Chemistry in your Environment", Albion Publishing Ltd., (1994).
6. Thomas G Spiro and William M Stigliani, "Chemistry of the Environment", Prentice Hall, (2002).
7. Kudisia V P and Ritu, "Environmental Chemistry", Pragati Prakashan, Meerut, (2000).

**15CHY243 FUELS AND COMBUSTION 3 0 0 3****Unit 1**

Fuels - Solid fuels - Classification, preparation, cleaning, analysis, ranking and properties - action of heat, oxidation, hydrogenation, carbonization, liquefaction and gasification.

Liquid fuels – Petroleum - origin, production, composition, classification, petroleum processing, properties, testing - flow test, smoke points, storage and handling.

Secondary liquid fuels - Gasoline, diesel, kerosene and lubricating oils. Liquid fuels - refining, cracking, fractional distillation, polymerization. Modified and synthetic liquid fuels. ASTM methods of testing the fuels.

**Unit 2**

Gaseous fuels - Types, natural gas, methane from coal mine, water gas, carrier gas, producer gas, flue gas, blast furnace gas, biomass gas, refinery gas, LPG - manufacture, cleaning, purification and analysis. Fuels for spark ignition engines, knocking and octane number, anti knock additives, fuels for compression, engines, octane number, fuels for jet engines and rockets.

Flue gas analysis by chromatography and sensor techniques.

**Unit 3**

Combustion: Stoichiometry, thermodynamics. Nature and types of combustion processes - Mechanism - ignition temperature, explosion range, flash and fire points, calorific value, calorific intensity, theoretical flame temperature. Combustion calculations, theoretical air requirements, flue gas analysis, combustion kinetics – hydrogen - oxygen reaction and hydrocarbon - oxygen reactions.

Rocket propellants and Explosives - classification, brief methods of preparation, characteristics; storage and handling.

**TEXTBOOK:**

*Fuels and Combustion, Samir Sarkar, Orient Longman Pvt. Ltd, 3rd edition, 2009.*

**REFERENCES:**

1. Fuels - Solids, liquids and gases - Their analysis and valuation, H. Joshua Philips, Bioblolife Publisher, 2008.
2. An introduction to combustion: Concept and applications - Stephen R Turns, Tata Mc. Graw Hill, 3rd edition, 2012.
3. Fundamentals of Combustion, D P Mishra, 1st edition, University Press, 2010
4. Engineering Chemistry - R. Mukhopadhyay and Sriparna Datta, Newage International Pvt. Ltd, 2007.

**15CHY244 GREEN CHEMISTRY AND TECHNOLOGY 3 0 0 3****Unit 1**

Our environment and its protection, chemical pollution and environmental regulations, environmental chemistry, pollution prevention strategies, challenges to the sustainability of chemical industry, Pollution Prevention Act 1990, USA, Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.

**Unit 2**

Greener strategies of the synthesis of ibuprofen synthesis, teriphthalic acid etc. phase behaviour and solvent attributes of supercritical CO<sub>2</sub>, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and CO<sub>2</sub> fixation, green plastics, green oxidations, etc.

**Unit 3**

Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.

**REFERENCES:**

1. *Hand Book of Green Chemistry and Technology*; by James Clarke and Duncan Macquarrie; Blakwell Publishing.
2. Anastas, P. T., Warner, J. C. *Green Chemistry: Theory and Practice*, Oxford University Press Inc., New York, 1998.
3. Matlack, A. S. *Introduction to Green Chemistry* Marcel Dekker: New York, NY, 2001.

**15CHY245 INSTRUMENTAL METHODS OF ANALYSIS 3 0 0 3****Unit 1**

Error Analysis and Sampling: Accuracy - Precision - Classification of Errors - Minimization of errors - Standard deviation - Coefficient of variance - F-test - t-test - Significant figures. Sampling - Basis of sampling, Sampling and physical state - Safety measures of sampling.

Separation Techniques: Brief out line of column, paper and thin layer chromatography - Ion exchange methods - principle and application – HPLC.

**Unit 2**

Gas chromatography - principle and applications – gel chromatography.

Electroanalytical techniques: Potentiometry - Potentiometric titration - determination of equivalence point - acid base, complexometric, redox and precipitation titrations - merits and demerits. Voltammetry - Cyclic voltammetry - basic principle and application - Polarography - introduction - theoretical principles - migration current - residual current - half wave potential - instrumentation - analytical applications.

**Unit 3**

Spectro-chemical techniques: UV-VIS spectrophotometry - principle - Beer's Law application - photometric titration - single and double beam spectrophotometer - instrumentation of IR - sample handling - IR applications - H - NMR - Instrumentation and applications - principle - instrumentation - applications of atomic absorption spectroscopy.

Thermal and Diffraction techniques: Principles and applications of DTG - DTA - DSC - X-ray - Electron Diffraction Studies - SEM, TEM.

**TEXTBOOKS:**

1. Willard H W, Merritt J R, "Instrumental Methods of Analysis", 6th edition, Prentice Hall, (1986).
2. Skoog Douglas A, West Donald, "Fundamentals of Analytical Chemistry", 7th edition, New York Addison, Wesley, (2001).

**REFERENCES:**

1. "Vogel's Textbook of Quantitative Chemical Analysis", 5th edition, ELBS, (1989).
2. Kaur. H, "Instrumental Methods of Chemical Analysis", Goel Publisher, (2001).

**15CHY246 MEDICINAL ORGANIC CHEMISTRY 3 0 0 3****Unit 1**

Medicinal Chemistry: Introduction, drugs - classification of drugs - mechanism of drug action. Drug-receptor complex nomenclature - agonist, antagonist.

Physicochemical properties in relation to biological action: solubility, partition coefficient, dissociation constant, hydrogen bonding, ionization, drug shape, surface activity, complexation, protein binding, molar refractivity, bioisosterism - Stereo chemical aspects of drug action-stereo isomerism-optical isomerism.

**Unit 2**

Enzymes and hormones: Enzymes - nomenclature, classification and characteristics of enzymes - mechanism of enzyme action, factors affecting enzyme action, cofactors and co-enzymes, enzyme inhibition, enzymes in organic synthesis. Hormones and vitamins - representative cases.

Medicinal agents from natural products: Natural products as therapeutic agents, medicinal plants, animal products as medicine, isolation methods of alkaloids, terpenes, anti-oxidants.

**Unit 3**

Medicinal agents: Medicinal agents belonging to steroids, polypeptides, modified nucleic acid bases, sulphonamide and sulpha drugs, antibiotics, antifungal, antiseptics and disinfectants, anaesthetics, antihypertensive drugs, analgesics, histamine and anti-histamine agents.

**TEXTBOOKS:**

1. Rama Rao Nadendla, "Principles of Organic Medicinal Chemistry", 1st edition, New age international (P) limited, (2005).
2. Thomas Nogrady and Donald F. Weaver, "Medicinal chemistry: A Molecular and Biochemical Approach", 3rd edition, Oxford university press, (2005).

**REFERENCES:**

1. Wilson C O, Gisvold O and Deorge R F, "Text book of organic, medicinal and Pharmaceutical chemistry", 7th edition, J.B.Lippincott company, Philadelphia, (1977).

- Burger A, "Medicinal Chemistry", 3rd edition, Wiley Interscience, Newyork, (1970).
- Graham L P, "An Introduction to Medicinal Chemistry", 3rd edition, Oxford university Press, (2005).

**15CHY247 MODERN POLYMER COMPOSITES 3 0 0 3****Unit 1**

General introduction to composite materials: Concept and definition, classification of composites (CMC, MMC, PMC). Functional roles of reinforcement and matrix and importance of interface. Polymer matrix composites (PMCs): Fiber reinforced and particulate filled polymer composites. Reinforcements (glass, carbon/graphite, Kevlar), Matrices - Thermoset matrices - polyesters, epoxides, phenolics, vinyl esters, polyimides, cyanate esters - Thermoplastic matrices. Choice of reinforcements and matrices for different application needs.

**Unit 2**

Fiber reinforced polymer composites (FRPs): Basic rule of mixtures, stress-strain relationships. Tailoring of structural properties through laminar-sequencing and choice of fiber fractions / fiber orientations, to meet design requirements. Mechanical behavior of FRP composites: Fiber controlled and matrix dependent properties. Fibre volume fraction, tensile, shear, compressive, flexural, thermo elastic and off – axis responses of lamina and laminates - notched strength – fracture toughness - nondestructive testing. Effect of environmental conditions on properties.

**Unit 3**

Composite precursors: SMCs, DMCs, BMCs prepreg materials and their choice in specific applications. Fabrication processes for FRP Composites: hand layup, spray up, vacuum bag moulding, compression moulding, filament winding, braiding, pultrusion, RTM, RIM, RRIM, RFI, autoclave moulding, injection moulding etc. Room temperature and hot curing of composites, Nanocomposites: Introduction; Nanoscale Fillers – Clay, POSS, CNT, nanoparticle fillers; Processing into nanocomposites;

Modification of interfaces; Properties. Applications. Joining composite elements and repairs, Recycling of polymer composites.

**TEXTBOOKS:**

- B. Astrom, "Manufacturing of Polymer Composites", CRC Press, 1997.
- P K Mallick, "Fiber-Reinforced Composites: Materials, Manufacturing, and Design", CRC Press, 2007.

**REFERENCES**

- F. C. Campbell (Ed), *Manufacturing processes for advanced composites*, Elsevier, 2004.
- S T Peters (Ed.), "Handbook of Composites", Springer, 1998.

**15CHY248 ORGANIC REACTION MECHANISMS 3 0 0 3****Unit 1**

Introduction to organic chemistry: Lewis structure and formal charges of organic compounds - electro negativities and dipoles, resonances, aromaticity and anti aromaticity - equilibrium, tautomerism and hyper conjugation - acidity and basicity - pKa, nucleophiles and electrophiles - hydrogen bonding - different types of organic reaction - addition, substitution, elimination and rearrangement - oxidations and reductions - general principles of writing organic reaction mechanism - reactive intermediates.

Reaction of nucleophiles and bases: Nucleophilic substitution - SN1 and SN2 reactions, nucleophilic substitution at aliphatic sp<sup>2</sup> carbon and aromatic carbon - nucleophilic addition to carbonyl compounds - addition of grignard and organo lithium reagents - reactions of nitrogen containing nucleophiles with aldehyde and ketones - aldol condensation.

**Unit 2**

Michael and 1,4-addition reaction - Favorskii rearrangement - benzoic acid rearrangement - reaction mechanism in basic media - Mannich reaction - enols and enolates.

Reaction involving acids and other electrophiles: Carbocations - formation and rearrangements - cationic rearrangement involving electron deficient nitrogen atom - Beckmann rearrangement - Curtius, Lossen and Schmidt rearrangement - electrophilic additions - acid catalyzed reaction of carbonyl compounds - hydrolysis of carbocyclic acid derivatives - electrophilic aromatic substitution - carbenes and benzynes - Baeyer-Villiger reactions - Dienone-phenol rearrangement - pinacol rearrangement.

**Unit 3**

Radical and radical ions: Formation of radicals, radical chain processes, radical addition, reaction with and without cyclisation - fragmentation reaction - rearrangement of radicals - SRN 1 reaction - radical ions - Birch reduction - Hofmann-Löffler-Freytag reaction - Barton reaction - McMurry reaction.

Pericyclic reaction: Representative of molecular orbitals of ethylene, butadiene and hexatriene molecules - Woodward - Hoffmann rules of symmetry - electrocyclic reaction, cycloadditions - diels-Alder reaction - other thermal cycloadditions - photochemical [2+2] cycloaddition - 1,3-dipolar cycloadditions - Sigmatropic reactions, notations and directions of [3,3] sigmatropic rearrangements - Cope and oxy-Cope rearrangement [2,3] sigmatropic reaction - ene reaction.

**TEXTBOOK:**

Jerry March, "Advanced Organic Chemistry", 4th edition, John Wiley & Sons, (1992).

**REFERENCES:**

1. Carey F and Sundberg R, "Advanced Organic Chemistry - Part A & B", Kluwer, (2000).
2. Peter Sykes, "Organic reaction mechanism", 6th edition, Pearson education (Singapore) Pte. Ltd., (2005).
3. Michael B. Smith, "Organic Synthesis", 2nd edition, McGraw Hill, (2004).

**15CHY249 ORGANIC SYNTHESIS AND STEREOCHEMISTRY 3 0 0 3****Unit 1**

Nomenclature of Organic compounds: Polyenes, Alkynes with and without functional groups by IUPAC nomenclature. Aromatic and Heteroaromatic systems - nomenclature of heterocycles having not more than two hetero atoms such as oxygen, sulphur, nitrogen.

Stereochemistry: Tacticity, R/S system of nomenclature of central and axial molecules.

**Unit 2**

Atropisomerism - isomerism of biphenyls - allenes and spiranes - ansa compounds - Geometrical isomerism, E, Z Isomerism. Asymmetric synthesis.

Conformational Analysis: Optical activity and chirality - Conformational Analysis of cyclic and acyclic system - Conformational effects on reactivity of acyclic systems only.

**Unit 3**

Asymmetric synthesis: Stereo selective - Stereo specific - Regioselective and Regiospecific reactions. Principle of protection of alcohol, amine, carboxyl and carbonyl groups - Functional group inter conversions - Disconnection approach - Reversal of polarity - reagents in synthesis.

**TEXTBOOKS:**

1. E. L. Eliel, "Stereochemistry of Carbon Compounds", McGraw Hill Book Co, (2000).
2. Jerry March, "Advanced Organic Chemistry", 4th edition, John Wiley & Sons, (1992).

**REFERENCES:**

1. S. Warren, "Designing Organic Synthesis", Wiley & Sons, (1998).
2. Finar I. L., "Organic Chemistry: Stereochemistry and the Chemistry of Natural Products", 5th edition, ELBS, (2000).

**15CHY250 POLYMER MATERIALS AND PROPERTIES 3 0 0 3****Unit 1**

Structure of polymers – thermoplastic, thermoset, rubber - Linear, branched, crosslinked, and network polymers – polymerization types – addition, condensation, mechanism, methods – bulk, solution, suspension and emulsion - crystalline, amorphous, orientation – molecular weight – intermolecular forces, solubility parameter- glass transition temperature.

**Unit 2**

Manufacturing, mechanical, thermal, electrical and chemical properties and applications of commodity plastics - PE, PP, PVC, PS, Engineering plastics - ABS, PC, PMMA, polyamide, polyacetal, PET, PBT, PTFE, High performance polymer - PES, PEI, PEEK, conducting polymer.

**Unit 3**

Thermoset materials - PF, UF, MF, epoxy and unsaturated polyester resin, Rubber - natural rubber, synthetic rubber - SBR, PB, nitrile, chloroprene, butyl, silicone - compounding and additives.

**TEXTBOOKS:**

1. J. A. Brydson, "Plastics Materials" Butterworth-Heinemann – Oxford, 7th Ed., London, 1999
2. Maurice Morton, "Rubber Technology", 3rd Ed, Kluwer Academic Pub, Dordrecht, Netherlands, 1999
3. ManasChanda and Salil K. Roy, "Plastics Technology Handbook", CRC Press, Atlanta, 2007

**REFERENCE BOOKS:**

1. D. W. Van Krevelena and P.J. Hoftyzen, "Properties of Polymer", 3rd Edition Elsevier Scientific Publishing Company Amsterdam – Oxford – Newyork. 1990.
2. Jozef Bicerano, "Prediction of Polymer Properties", Second Edition, Marcel Dekker Inc. New York, 1995.

**15CHY251 POLYMERS FOR ELECTRONICS 3 0 0 3****Unit 1**

Conducting polymers: Conducting mechanisms - Electron transport and bipolar polymers - electrodepositable resists, resins. Applications - Organic light emitting diodes, Sensors, EMI shielding, printed Circuit Boards, Artificial nerves, Rechargeable Batteries, Electromechanical Actuators and switches.

**Unit 2**

Photoconductive polymers: Charge carriers, charge injectors, charge transport, charge trapping. Polymers for optical data storage - principles of optical storage, polymers in recording layer.

Nonlinear optics: NLO properties and NLO effects, wave guide devices, polymer optical fibers - through plane modulators.

**Unit 3**

Thermosensitive polymers: Applications - Mechanical actuators and switches - Tissue culture, Drug delivery, Photo resists - Types - Chemically amplified photoresists - Applications. Magnetic polymers - structure and Applications.

Liquid crystalline polymers: Fundamentals and process, liquid crystalline displays - Applications.

**TEXTBOOK:**

Kiichi Takemoto, Raphael M. Ottenbrite, Mikiharu Kamachi, "Functional Monomers and Polymers", CRC Press, (1997).

**REFERENCES:**

1. A B Kaiser, "Electronic properties of conjugated polymers - basics, models and applications", Springer Verlag, (1987).
2. J. A. Chilton and M T Goosy, "Special polymers for electronics and optoelectronics", Kluwer Academic Publishers, (1995).

**15CHY252 SOLID STATE CHEMISTRY 3 0 0 3****Unit 1**

Symmetry in Crystal Systems: Types of symmetry, plane, axis and centre of symmetry, crystal systems and symmetry elements. Law of rational indices, miller indices, Weiss indices - plane systems, space lattices, unitcells - unitcell dimension, determination. Space lattice - definition and types Bravais lattice - kinds of bravais lattices, number of atoms in SC, BCC, FCC lattices, void space, Radius ratio rule and application. Crystal defects - types of defects in crystals - stoichiometric defect - schottky and frenkel defects - Non-stoichiometric defects - metal excess and metal deficiency defects, influence of defects on the properties of solids.

**Unit 2**

Electrical and Magnetic Properties: Development of free electron theory to band theory of solids - metals and their properties; semiconductors - extrinsic and intrinsic, Hall effect; Insulators - dielectric, ferroelectric, pyroelectric and piezoelectric properties and the relationship between them. Dia, para, ferro, ferri, antiferro and antiferri magnetic types - selected magnetic materials such as spinels, garnets and perovskites, superconductors.

Diffraction Methods: X-ray diffraction - various methods of X-ray analysis of structure-ray diffraction pattern, X-ray scattering factor. Results and uses of X-ray diffraction. Limitations of X-ray diffractions.

**Unit 3**

Neutron diffraction - principles, electron diffraction patterns, limitations - applications of electron diffraction - structural elucidation. Distinction between X-ray, Neutron and electron diffraction. Structure factor - definition, factors influencing structure factor. Uses of structure factor.

Fourier synthesis - definition, applications of fourier synthesis in crystal structure analysis of S-Tetrazine. Structure of Rutile, Fluorite, Antifluorite, Zinc blende, Wurtzite, diamond and graphite.

**REFERENCES:**

1. Cotton F. A, Wilkinson G and Gaus P, "Basic Inorganic Chemistry", 3rd edition, John Wiley and Sons, (2003).
2. Shriver D. F and Atkins P. W, "Inorganic Chemistry", 3rd edition, ELBS, Oxford University Press, Oxford, (2004).
3. Huheey J. E, Keiter E. A and Keiter R. L, "Inorganic Chemistry", 4th edition, Addison-Wesley Pub. London, (1993).
4. Cotton F. A, Wilkinson G, Murillo C. A and Bochmann M, "Advanced Inorganic Chemistry", 6th edition, John Wiley and Sons, New York, (2003).
5. Jolly W. L, "Modern Inorganic Chemistry", 2nd edition, McGraw-Hill, Inc., (1991).
6. Miessler G. L and Tarr D. A, "Inorganic Chemistry", 3rd edition, Pearson Education, Singapore, (2004).

**15CHY331 BATTERIES AND FUEL CELLS 3 0 0 3****Unit 1**

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

**Unit 2**

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells - liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

### Unit 3

Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

Membranes for fuel cells: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.

Fuels for Fuel Cells: Hydrogen, methane, methanol - Sources and preparation, reformation processes for hydrogen – clean up and storage of the fuels – use in cells, advantages and disadvantages of using hydrogen as fuel.

#### TEXTBOOKS:

1. Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry, (2001).
2. M. Aulice Scibioh and B. Viswanathan 'Fuel Cells – principles and applications', University Press, India (2006).

#### REFERENCES:

1. Kanani N, 'Electroplating and electroless plating of copper and its alloy', ASM International, Metals Park, OH and Metal Finishing Publications, Stevenage, UK (2003).
2. Curtis, 'Electroforming', London, (2004).
3. F. Barbir, 'PEM fuel cells: theory and practice', Elsevier, Burlington, MA, (2005).
4. G. Hoogers, 'Fuel cell handbook', CRC, Boca Raton, FL, (2003).

## 15CHY332 CORROSION SCIENCE 3 0 0 3

### Unit 1

Basic principles: Free energy concept of corrosion - different forms of corrosion - Thermodynamic & Kinetic aspects of corrosion: The free energy criterion of corrosion possibility - Mechanism of Electrochemical corrosion - Galvanic and Electrochemical series and their significance.

Corrosion Control: Materials selection - metals and alloys - metal purification - non metallic - changing medium.

### Unit 2

Anodic and cathodic protection methods - Coatings - metallic and other inorganic coatings - organic coatings - stray current corrosion - cost of corrosion control methods.

Corrosion protection by surface treatment: CVD and PVD processes - Arc spray - Plasma spray - Flame spray.

Corrosion Inhibitors: Passivators - Vapour phase inhibitor.

### Unit 3

Stress and fatigue corrosion at the design and in service condition - control of bacterial corrosion.

Corrosion protection: Automobile bodies – engines – building construction.

#### TEXTBOOKS:

1. Fontana and Mars G, "Corrosion Engineering", 3rd edition, McGraw Hill, (1987).
2. Uhlig H H and Reviees R W, "Corrosion and its Control", Wiley, (1985).

#### REFERENCES:

1. ASM Metals Handbook, "Surface Engineering", Vol. 5, ASM Metals Park, Ohio, USA, (1994).
2. ASM Metals Handbook, "Corrosion", Vol. 13, ASM Metals Park, Ohio, USA, (1994).
3. Brain Ralph, "Material Science and Technology", CRC Series, Boston, New York.

## 15CSE100 COMPUTATIONAL THINKING AND PROBLEM SOLVING 3 0 2 4

### Unit 1

Basics: Introduction, Information and data, Data encoding. Logic: Boolean logic, Applications of propositional logic.

### Unit 2

Problem Solving and Algorithmic Thinking: Problem definition, Logical reasoning, Problem decomposition, Abstraction. Flowcharting, Name binding, Selection, Repetition, Modularization. Data organization: List and Arrays. Simple algorithms, comparison of performance of algorithms.

### Unit 3

Problem Solving Techniques: Factoring and Recursion Techniques, Search and Sort techniques, Text processing and Pattern matching.

#### TEXTBOOKS:

1. David Riley and Kenny Hunt, Computational Thinking for Modern Solver, Chapman & Hall / CRC, 2014
2. R. G. Dromey, "How to solve it by Computer", PHI, 2008

**15CSE102 COMPUTER PROGRAMMING 3 0 0 3****Unit 1**

Introduction to C language: Structure of a C program, comments, Data types, Variables, constants, Data input and output statements, input assertions; expressions and evaluation. Functions: inter function communication, standard functions, scope. Selection: two way selection, multi-way selection, repetition: concept of loop, loop invariant, pretest and post-test loops, initialization and updating, event and counter controlled loops. Recursion: recursive definition, recursive solution, designing recursive functions, limitations of recursion.

**Unit 2**

Files and streams, file input output. Arrays - 1D numeric, searching and sorting, 2D numeric arrays: problems with matrices. Pointers: introduction, compatibility, arrays and pointers, Dynamic memory allocation, array of pointers, pointer arithmetic.

**Unit 3**

Strings: fixed length and variable length strings, strings and characters, string input output, array of strings, string manipulation functions, sorting of strings. Enumerated types, Structures: Structure vs array comparison, complex structures, Structures and functions, Union, binary input output, Command line arguments.

**TEXTBOOK:**

Behrouz A. Forouzan and Richard F. Filberg, "Computer Science A structured programming approach using C", Third Edition, Cengage Learning, 2006.

**REFERENCES:**

1. Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language", Second Edition, Prentice Hall, 1988.
2. Eric S. Roberts, "Art and science of C", Addison Wesley, 1995.
3. Jeri Hanly and Elliot Koffman, "Problem solving and program design in C", Fifth Edition, Addison Wesley (Pearson), 2007.

**15CSE111 COMPUTER SCIENCE ESSENTIALS 3 0 0 3****Unit 1**

Introduction to Computer Science: Role of Algorithms, History of Computing, Science of Algorithms, Abstractions. Basics of data encoding and storage: Bits and their storage, Main memory, Mass Storage, Representing Information as Bit Patterns. Machine Architecture: CPU Basics, Stored Program concepts, Machine Language Introduction with example, Program Execution with illustrative example.

**Unit 2**

Operating Systems: History of OS, OS Architecture, Coordinating Machine Activities. Networking and the Internet: Network Fundamentals, The Internet, The World Wide Web. Software Engineering: Introduction, Software Life Cycle. Database Systems: Database Fundamentals, Relational Model.

**Unit 3**

Computer Graphics: Scope of Computer Graphics, Overview of 3D Graphics. Artificial Intelligence: Intelligence and Machines, Perception, Reasoning. An Introduction to topics of research in the department.

**TEXTBOOK:**

J. Glenn Brookshear, "Computer Science: An Overview", Addison-Wesley, Twelfth Edition, 2014.

**15CSE180 COMPUTER PROGRAMMING LAB. 0 0 2 1**

Solving simple problems with operators, programs on conditional control constructs, programs on loops (while, do-while, for), programs using user defined functions and library functions, programs on Files, arrays, matrices (single and multi-dimensional arrays), programs using DMA, programs on strings, structures.

**REFERENCE:**

Behrouz A. Forouzan and Richard F. Filberg, "Computer Science A structured programming approach using C", Third Edition, Cengage Learning, 2007.

**15CSE201 DATA STRUCTURES AND ALGORITHMS 3 1 0 4****Unit 1**

Introduction: Overview of Data Structures – A Philosophy of Data Structures - The Need for Data Structures – Cost and Benefits - Abstract Data Types and Data Structures - Principles, and Patterns. Basic complexity analysis – Best, Worst, and Average Cases - Asymptotic Analysis -Analyzing Programs – Space Bounds, Arrays, Linked Lists and Recursion: Using Arrays - Lists - Array based List Implementation – Linked Lists – LL ADT – Singly Linked List – Doubly Linked List – Circular Linked List – recursion- linear, binary, and multiple recursions.

Stacks and Queues: Stack ADT - Array based Stacks, Linked Stacks – Implementing Recursion using Stacks, Queues - ADT, Array based Queue, Linked Queue, Double-ended queue, Circular queue.

**Unit 2**

Trees: Tree Definition and Properties – Tree ADT - Basic tree traversals - Binary tree - Data structure for representing trees – Linked Structure for Binary Tree –

Array based implementation. Priority queues: ADT – Implementing Priority Queue using List – Heaps. Maps and Dictionaries: Map ADT – List based Implementation – Hash Tables - Dictionary ADT - Skip List – Complexity.

**Unit 3**

Search trees – Binary search tree, AVL tree, Trees – K-D Trees - B-Trees. Sorting and Selection – Linear Sorting – Heap Sort - Divide and Conquer Strategy – Analysis using Recurrence Tree based Method - Merge Sort - Quick Sort - Studying Sorting through an Algorithmic Lens – Selection – External Memory Sorting and Searching. Graphs: ADT- Data structure for graphs - Graph traversal- Transitive Closure- Directed Acyclic graphs - Weighted graphs – Shortest Paths - Minimum spanning tree – Greedy Methods for MST.

**TEXTBOOKS:**

1. Goodrich M T and Tamassia R, "Data Structures and Algorithms in Java", Fifth edition, Wiley publication, 2010.
2. Clifford A. Shaffer, "Data Structures and Algorithm Analysis", Third Edition, Dover Publications, 2012.

**REFERENCES:**

1. Goodrich M T, Tamassia R and Michael H. Goldwasser, "Data Structures and Algorithms in Python++", Wiley publication, 2013.
2. Tremblay J P and Sorenson P G, "An Introduction to Data Structures with Applications", Second Edition, Tata McGraw-Hill, 2002.

**15CSE202 OBJECT - ORIENTED PROGRAMMING 3 0 0 3****Unit1**

Introduction to object oriented software design, Comparison of programming methodologies, Object Basics, Java Environment, Classes and Object, Data Members, Access Specifiers, Arrays within a Class, Array of Objects, Constructors, Default Constructors, Destructors, Static Members, Constant Members, Object Oriented Design with UML, Class, object diagrams and sequence diagrams.

**Unit 2**

Overview of Streams, Bytes vs. Characters, File Object, Binary Input and Output, Reading and Writing Objects, Method Overriding, Polymorphism, Inheritance, Interfaces and Abstract Classes, Packages, Use case diagrams and activity diagrams.

**Unit 3**

Introduction to Threads, Creating Threads, Thread States, Runnable Threads, Coordinating Threads, Interrupting Threads, Runnable Interface Applets: Applet

Architecture - Parameters to Applet - Embedding Applets in Web page, Component diagrams and Deployment diagrams.

**TEXTBOOK:**

1. Naughton P. and Schildt H., "Java2 Complete Reference", Eighth Edition, Tata McGraw- Hill, 2011.
2. Ali Bahrami, "Object Oriented Systems Development", Second Edition, McGraw-Hill, 2008.

**REFERENCES:**

1. Grady Booch and Robert A. Maksimchuk, "Object-oriented Analysis and Design with Applications", Third Edition, Pearson Education, 2009.
2. Jaime Nino, Fredrick AHosch, "An Introduction to Programming and Object Oriented Design using Java", Wiley India Private Limited, 2010.

**15CSE211 DESIGN AND ANALYSIS OF ALGORITHMS 3 1 0 4**

(Pre-requisite: 15CSE201 Data Structures and Algorithms)

**Unit 1**

Introduction - Algorithms vs programs. Flow charts and pseudo code, Rate of growth of functions. Asymptotic notation: motivation and types of notations. Recurrence relations and methods to solve them: Recursion tree, substitution, Master Method, Sorting: Bubble – Insertion – Selection – Bucket – Heap, Comparison of sorting algorithms, Divide and Conquer: Quick sort – Merge sort – Binary search – Long integer multiplication – Maximum sub array sum.

**Unit 2**

Greedy Algorithm - Introduction to the method, Fractional Knapsack problem, Task Scheduling Problem, Dynamic Programming: Introduction to the method, Fibonacci numbers, 0-1 Knapsack problem, Matrix chain multiplication problem. Backtracking, Branch and Bound 0-1 Knapsack, N- Queen problem.

**Unit 3**

Graph Algorithms - Graph Traversal: Applications of BFS: distance, connectivity and connected components and cycles in undirected graphs. Applications of DFS: Topological sort, cycles in directed graphs, Biconnected Components and Strong Connectivity. Path algorithms: Shortest path algorithms (along with analysis) SSSP: Bellman Ford. APSP: Floyd Warshall's. Minimum Spanning Tree (with analysis and applications). Introduction to NP class: Definitions P, NP, NP complete, NP hard, Examples of P and NP.

**TEXTBOOK:**

- Goodrich M T and Tamassia R, "Algorithm Design Foundations - Analysis and Internet Examples", John Wiley and Sons, 2007.



**REFERENCES:**

1. Cormen T H, Leiserson C E, Rivest R L and Stein C, "Introduction to Algorithms", Prentice Hall of India Private Limited, Third Edition, 2009.
2. Dasgupta S, Papadimitriou C and Vazirani U, "Algorithms", Tata McGraw-Hill, 2009.

**15CSE212 INTRODUCTION TO EMBEDDED SYSTEMS 3 0 0 3****Unit 1**

Architecture of Microprocessors: General definitions of computers, microprocessors, micro controllers and digital signal processors. Overview of Intel microprocessors: Introduction to 8086 microprocessor, Signals and pins of 8086 microprocessor, Addressing Modes, Instruction set, Assembler directives, simple programs, procedures, and macros. Pin diagram of 8086 - Minimum mode and Maximum mode of operation. Timing diagram. Memory interfacing to 8086 (Static RAM & EPROM). Need for DMA. DMA data transfer Method.

Introduction to 80486, Pentium, and Core Architectures.

**Unit 2**

ARM Architecture: RISC Machine, Architectural inheritance, Programmers model. ARM Organization and Implementation: 3-stage pipeline, 5-stage pipeline, ARM instruction execution, ARM implementation, Co-processor interface. ARM Assembly Language Programming: Data processing instructions, Data transfer instructions, Control flow instructions, Architectural support for high-level programming, Thumb instruction set.

**Unit 3**

Interrupt structure of 8086 and ARM: Vector interrupt table, Interrupt service routines, Introduction to DOS and BIOS interrupts for 8086. Asynchronous and Synchronous data transfer schemes. ARM memory interface, AMBA interface. A/D converters, PWM, Timer / Counter, UART and its interfacing - Application development using Keil IDE.

**TEXTBOOK:**

1. Barry B Brey, "The Intel Microprocessors 8e (VTU): 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4 and Core2 with 64-bit Extensions", Pearson Education, Eight Edition, 2012.
2. Steve Furber. "ARM system On-Chip-Architecture", Second Edition, Addison Wesley, 2000.

**REFERENCES:**

1. Douglas Hall, "Microprocessors and its Interfacing (SIE)", McGraw Hill Education (India), Third Edition, 2012.
2. Yu-Cheng Liu & Glenn A Gibson, "Microcomputer systems 8086/8088 family, Architecture, Programming and Design", Prentice Hall, Second Edition, July 2003.

3. Arnold S. Berger, "Embedded System Design", CMP Books, First Edition, Taylor & Francis, 2002.
4. Michael Barr, "Programming Embedded Systems with C and GNU", First Edition, O Reilly, 2003.

**15CSE213 OPERATING SYSTEMS 3 1 0 4****Unit 1**

Introduction to Operating Systems: Overview - Types of systems - Computer system operations - Hardware Protection - Operating systems services - System calls - System structure - Virtual machines. Process Management: Process concepts - Process scheduling - Operations on Process - Cooperating process - Interprocess communication - Multithreading models - Threading issues - Thread types - CPU scheduling –scheduling algorithms.

**Unit 2**

Process Synchronization: Critical section problem - synchronization hardware – Semaphores - Classical problems of synchronization - Critical regions – Monitors – Deadlocks - Deadlock characterization - Methods of handling deadlocks - Deadlock prevention – Avoidance - Detection and recovery.

**Unit 3**

Storage Management: Memory management – Swapping - Contiguous memory allocation. Paging – Segmentation - Segmentation with Paging - Virtual memory - Demand paging - Process creation – page replacement - Thrashing. File Systems: Directory structure - Directory implementation - Disk scheduling. Case study: Threading concepts in Operating systems, Kernel structures.

**TEXTBOOK:**

Silberschatz and Galvin, "Operating System Concepts", Ninth Edition, John Wiley and Sons, 2012.

**REFERENCES:**

1. Deitel. Deitel and Choffnes, "Operating System", Third edition, Prentice Hall, 2003.
2. Tannenbaum A S, "Modern Operating Systems", Third edition, Prentice Hall, 2007.
3. Stevens W R and Rago S A, "Advanced Programming in the Unix Environment", Second Edition, Addison-Wesley, 2013.
4. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2009.

**15CSE281 DATA STRUCTURES LAB. 0 0 2 1**

Object Oriented Programming, Using Arrays and Array Lists, Linked list: Implementation using Arrays, Application of Linked Lists, Stacks: Array implementation, Linked Implementation, and Applications, Queues: Array implementation, Linked Implementation and Applications, Using linear data structures in Recursion,

Scheduling, and other practical applications, Implementing Priority Queues and using existing implementation for applications, Binary search tree and Application, Graph ADT, Traversal, Modelling Problems using Graphs, Minimum Spanning Trees, Hash Table and Dictionary Applications.

**15CSE282 OBJECT - ORIENTED PROGRAMMING LAB. 0 0 2 1**

Input / Output statements, Manipulators, Structures, Classes, Objects, Static members and functions, Constructors and destructors, Constructor overloading, Function overloading, Forms of inheritance, Exception handling, Interfaces, Multithreading, Thread Synchronization, Applets.

**15CSE285 EMBEDDED SYSTEMS LAB. 0 0 2 1**

Intel 8086 Assembly program for Arithmetic and Logical Operations, Intel 8086 Procedures and Macros, ARM Assembly program for Arithmetic and Logical Operations, ARM Assembly program for Multi-byte Operations, ARM Assembly program for Control Manipulation, ARM Assembly program for String Manipulation, ARM Assembly program for Thumb Instructions, Embedded C Programming using Keil Simulator - Simple C Programs, Port Programming. Peripheral Interfacing – Keypad, Motor, LED.

**15CSE286 OPERATING SYSTEMS LAB. 0 0 2 1**

Unix Commands - Shell scripts – Awk programming - Process Management: Process creation, Thread Creation - Interprocess Communication: Pipes and Shared memory - Scheduling algorithms: First Come First Serve, Shortest Job First, Priority, Round Robin – Process Synchronisation: Critical Section problem for two processes, Semaphores, Classical problems in Semaphores – Deadlock Management: Banker's algorithm of Deadlock Avoidance, Deadlock Detection algorithm - Memory Management: Page replacement policies.

Case Study / project: Mobile OS: Android, iOS – NachOS / Minix / Linux Kernel: study of any one module

**15CSE301 COMPUTER ORGANIZATION AND ARCHITECTURE 3 0 0 3**

**Unit 1**

Introduction and Performance of Computing system, Processor Architecture with example as MIPS & Instruction Set, Single Cycle Datapath Design, Control Hardware, Computer Arithmetic, Floating Point Arithmetic, Role of performance.

**Unit 2**

Introduction to multicycle datapath, Pipelining Technique – Design Issues, Hazards: Structural Hazards, Data Hazards and Control Hazards, Static Branch Prediction, Dynamic Branch Prediction, Advanced Concepts in pipelining.

**Unit 3**

Memory Organization - Introduction, Cache Memory Organization, Main Memory & Interleaving, I/O Organization, Modern Processors, Parallel Processing.

**TEXTBOOKS:**

1. Patterson, David A and J L Hennessy, "Computer Organisation & Design, The Hardware/Software Interface (ARM Edition)", Morgan Kaufmann, Fifth Edition, Newness, 2013.
2. Hennessy and Patterson, "Computer Architecture: A Quantitative Approach", Elsevier, Fifth Edition, 2011.
3. W Stallings, "Computer Organisation & Architecture: Designing for Performance", Pearson, Eighth Edition, 2010
4. V. Carl Hamacher, Zvonko G. Varanescic and Safat G. Zaky, "Computer Organisation", Fifth Edition, McGraw Hill Education (India), 2011.

**15CSE302 DATABASE MANAGEMENT SYSTEMS 2 0 2 3**

**Unit 1**

Introduction: Overview of DBMS, File vs DBMS, elements of DBMS. Database design: E-R model, Notations, constraints, cardinality and participation constraints, ER design issues, Weak and strong entity sets, Extended ER features. Relational Data Model: Introduction to relational model, Structure of relational mode, domain, keys, tuples to relational models.

**Unit 2**

Relational Database Design: Functional dependency, Normalization: 1NF, 1NF, 2NF, 3NF, BCNF, Relational Synthesis algorithm, Lossless join testing algorithm, Decomposition Using Functional Dependencies, Functional-Dependency Theory - Reduction of ER model to Relational model. SQL: Various DDLs, DMLs, DCLs.

**Unit 3**

Indexing Mechanisms: Clustered, Non-Clustered, B-tree, B+tree, Hash based. Transactions: Transaction Concept, Transaction model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability Concurrency control: Lock-based protocols – Locks, Granting of Locks, The Two-Phase Locking Protocol, Implementation of Locking, Graph-Based Protocols. Deadlock handling: Deadlock Prevention, Deadlock Detection and Recovery, Deadlock Detection, Recovery from Deadlock.

**TEXTBOOK:**

Silberschatz A, Korth H F and Sudharshan S, "Database System Concepts", Sixth Edition, Tata McGraw-Hill Publishing Company Limited, 2011.

**REFERENCES:**

1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, "Database Systems: The Complete Book", Second edition, 2011.
2. Elmasri R and Navathe S B, "Fundamentals of Database Systems", Fifth Edition, Addison Wesley, 2006.
3. Ramakrishnan R and Gehrke J, "Database Management Systems", Third Edition, McGraw-Hill, 2003.

**15CSE303****THEORY OF COMPUTATION****3 0 0 3****Unit 1**

Automata and Languages: Chomsky hierarchy of languages, Introduction Finite Automata - Regular Expressions - Nondeterministic Finite Automata - equivalence of NFAs and DFAs – Minimization of DFA.

**Unit 2**

Regular Expressions - Non-Regular Languages - Pumping Lemma for regular languages.

**Unit 3**

Parse tree derivations (top-down and bottom-up) Context free languages – Chomsky normal form, GNF - Push Down Automata - Pumping lemma for context free language. CYK Algorithm, Deterministic CFLs. Ambiguous grammar, removing ambiguity, Computability Theory: Turing Machines - Non-deterministic Turing Machines – CSG, Undecidability - PCP Computation histories – Reducibility.

**TEXTBOOK:**

Linz P, "An Introduction to Formal Languages and Automata", Fourth Edition, Narosa Publishing House, 2009

**REFERENCES:**

1. Michael Sipzer, "Introduction to the Theory of Computation", Third Edition, Cengage Learning, 2012.
2. Martin and John, "Introduction to Languages and the Theory of Computation", New York, McGraw Hill, 2002.
3. Garey, Michael and Johnson D S, "Computers and Intractability: A Guide to the Theory of NP - Completeness", New York, W.H. Freeman and Company, First Edition, 1979.
4. J E Hopcroft, R Motwani and J D. Ullman, "Introduction to Automata Theory, Languages, and Computation", Third Edition, Addison-Wesley, 2007.

**15CSE311****COMPILER DESIGN****3 1 0 4****Unit 1**

Overview of Compilation: Compiler Structure – Overview of Translation. Lexical Analysis: Regular Expressions – From Regular Expression to Scanner – Implementing Scanners. Parsers: Expressing Syntax – Top-Down and Bottom-Up Parsing – LR(0), LR(1) and LALR(1).

**Unit 2**

Context-Sensitive Analysis: Type Systems – Attribute - Grammar – Syntax Directed Translation, Intermediate Representations: Graphical and Linear Intermediate Representations – Symbol Tables. Procedure Abstraction: Procedure Calls – Name Spaces – Communicating Values between Procedures.

**Unit 3**

Iterative Data Flow Analysis – Instruction Selection via Tree-Pattern Matching – Register.

Allocation: Local and Global – Introduction to Optimization.

**TEXTBOOK:**

Keith Cooper and Linda Torczon, "Engineering a Compiler", Second Edition, Morgan Kauffman, 2011.

**REFERENCES:**

1. Ronald Mak, "Writing Compilers and Interpreters: A Software Engineering Approach", John Wiley & Sons, Third Edition, 2009.
2. Andrew W. Appel and Jens Palsberg, "Modern Compiler Implementation in Java", Cambridge University Press, Second Edition, 2002.
3. Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Prentice Hall, Second Edition, 2006.

**15CSE312****COMPUTER NETWORKS****3 0 0 3****Unit 1**

The Internet - The Network Edge, the Network Core, Delay, Loss, and Throughput in Packet Switched Networks, Protocol Layers and Their Service Models. Principles of Network Applications: The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, DNS - The Internet's Directory Service, Peer-to-Peer Applications. Introduction and Transport Layer Services: Multiplexing and Demultiplexing, Connectionless Transport - UDP, Principles of Reliable Data Transfer.

**Unit 2**

Transport layer - Connection Oriented Transport - TCP, Principles of Congestion Control, TCP Congestion Control. Introduction Network Layer: Virtual Circuit and Datagram

Networks, Inside a Router, The Internet Protocol (IP) - Forwarding and Addressing in the Internet, Routing Algorithms, Routing in the Internet, Broadcast and Multicast Routing.

### Unit 3

The Link Layer and Local Area Networks - Introduction and Services, Error-Detection and Correction Techniques, Multiple Access Protocols, Link-Layer Addressing, Ethernet, Link-Layer Switches, PPP - The Point-to-Point Protocol.

#### TEXTBOOK:

Kurose J F and Ross K W, "Computer Networking: A Top-Down Approach", Sixth Edition, Pearson Press, 2013.

#### REFERENCES:

1. Tanenbaum A S, "Computer Networks", Third Edition, PHI, 2004.
2. Stallings W, "Data and Computer Communications", Seventh Edition, Pearson Education Asia, 2004.
3. Forouzan B A, "Data Communication and Networking", Third Edition, Tata McGraw Hill, 2004.

## 15CSE313

## SOFTWARE ENGINEERING

2 0 2 3

### Unit 1

Software Engineering Concepts - A Generic view of Process - Categories of Software - Process Models - Perspective models - Waterfall model - Incremental models - Evolutionary models - Specialized models - Unified Process Models. Requirements Engineering: Tasks Initiation – Elicitation - Developing Use Cases - Building the analysis model – Negotiation - Validation - Building the Analysis Model.

### Unit 2

Requirement Analysis – Approaches - Data modelling concepts - OO Analysis - Scenario Based modelling - Flow Oriented modelling - Class based modelling -

Behavioural Modelling. Design Engineering: Design Process and Quality - Design Concept – Model - Creating an Architectural Design - Software Architecture - Data Design - Architectural Styles and Patterns - Architectural Design - Mapping Data Flow into Software Architecture – Modelling Component level design – Component-Class based Components - Conducting component level design -Designing conventional components.

### Unit 3

Performing user interface design - Golden Rules - User interface Analysis and Design - Interface Analysis - Interface design steps - Web Engineering - Attributes, Layers, Processes and best Practices - Initiating, Analysis, Design and Testing of Webapp projects, Testing Strategies: Testing Tactics - Testing fundamentals - Black-box and White-box Testing - Product Metrics. Case Study: SWEBOK.

#### TEXTBOOK:

Pressman R S, Bruce R.Maxim, "Software engineering - A Practitioner's Approach", Eighth Edition, Tata McGraw-Hill, 2014.

#### REFERENCES:

1. Sommerville I, "Software Engineering", Sixth Edition, Addison Wesley, 2003.
2. Fairley R, "Software Engineering Concepts", Seventh Edition, Tata McGraw-Hill, 1999.
3. G J Myers, Corey S, Tom B and Todd M T, "The Art of Software Testing", Third Edition, Wiley, 2011.
4. Pankaj J, "An Integrated Approach to Software Engineering", Third Edition, Narosa Publishing House, 2005.

## 15CSE330

## INFORMATION TECHNOLOGY ESSENTIALS

3 0 0 3

### Unit 1

Computer hardware and system software concepts: Computer Architecture, system software, Operating Systems, Computer Networking. Programming fundamentals; problem solving concepts, modular approach through use of functions, error handling techniques, structured Programming and data structures, structured statements, string handling functions, sorting and searching, file handling functions, Object oriented concepts; Managing software complexity, concepts of object oriented programming, abstraction, class, object, member data, member methods, encapsulation, data hiding, inheritance, polymorphism, binding.

### Unit 2

Analysis of algorithms; principles and tools for analysis of algorithms, analysis of popular algorithms, code tuning techniques, intractable problems, Relational Database management; basic RDBMS concepts, database design, SQL comments, embedded SQL concepts, OLTP concepts.

### Unit 3

System development methodology; software engineering development life cycle (SDLC), quality concepts and quality system procedures, analysis and design methods, structured programming concepts and principles of coding, software testing. User interface design: process of user interface design, elements of user interface design, speech user interface, web design issues. Introduction of web architecture: basic architecture of web application, security, and performance of web based applications, architecture documents.

#### REFERENCES:

1. Andrew. S. Tanenbanum, "Structured Computer Organization", Fourth Edition, PHI, 1999.
2. Abraham Silberschatz, Henry F Korth, S. Sudharshan, "Database System Concepts", Fourth Edition, Tata McGraw, 1997.
3. Roger S Pressman, "Software Engineering – A practitioner's approach", Sixth Edition, McGraw Hill Publishers, 2004.

**15CSE331 ADVANCED ALGORITHMS AND ANALYSIS 3 0 0 3****Unit 1**

Algorithm Analysis- Methodologies for Analyzing Algorithms, Asymptotic growth rates, Amortized Analysis. Number Theory: Preliminaries, FLT, Euclid's algorithm (extended). Totient function, Sieve for primes, Inverse modulo n, Modular exponentiation, Applications of graph algorithms: Topological sort, Strongly Connected Components, Bi-connected Components, Bridges, Articulation points. All Pair Shortest Paths, Single Source Shortest Paths. Computational Geometry: Convex Hull, closest pair of points in 2D, the triangle with smallest perimeter in 2D, Determining whether a set of line segments have one or more intersections.

**Unit 2**

Applications of Divide-and-Conquer, Greedy techniques and Dynamic Programming - Knapsack, Median finding, Scheduling algorithms, Party planning, bitonic TSP etc., String matching algorithms: KMP, Rabin Karp, Aho-Corasick, 2D queries, efficient algorithms for longest palindrome, Longest Common Substring.

**Unit 3**

Flow Networks: Ford-Fulkerson, Edmonds Karp, Applications of maximum flows - Efficient algorithms for maximum bipartite matching, minimum cost matching. NP-Completeness: Important NP-Complete Problems, Polynomial time reductions, Approximation algorithms, Parallel Algorithms (overview): Tree Contraction - Divide and Conquer - Maximal Independent Set. External-Memory Algorithms - Accounting for the Cost of Accessing Data from Slow Memory - Sorting - B-trees - Cache-oblivious Algorithms for Matrix Multiplication and Binary Search.

**TEXTBOOK:**

Goodrich M T and Tamassia R, "Algorithm Design and Applications", John Wiley and Sons, 2014.

**REFERENCES:**

1. Cormen T H, Leiserson C E, Rivest R L and Stein C, "Introduction to Algorithms", Prentice Hall of India Private Limited, Third Edition, 2009.
2. Rajeev Motwani and Prabhakar Raghavan, "Randomized Algorithms", Cambridge University Press, 1995.
3. Vijay V. Vazirani., "Approximation Algorithm", Springer, 2003

**15CSE332 ADVANCED COMPUTER ARCHITECTURE 3 0 0 3****Unit 1**

Instruction Level Parallelism: ILP - Concepts and challenges - Hardware and software approaches - Dynamic scheduling - Speculation - Compiler techniques for exposing ILP- Branch prediction. VLIW & EPIC - Advanced compiler support -

Hardware support for exposing parallelism - Hardware versus software speculation mechanisms - IA 64 and Itanium processors - Limits on ILP, Data-Level Parallelism in Vector, SIMD, and GPU Architectures: Introduction - vector architecture - working - performance - SIMD Instruction Set Extensions for Multimedia - Graphics Processing units - GPGPU.

**Unit 2**

Multiprocessors and Thread level Parallelism: Symmetric and distributed shared memory architectures - Performance issues - Synchronization - Models of memory consistency - Introduction to Multithreading Memory and I/O: Cache performance - Reducing cache miss penalty and miss rate - Reducing hit time - Main memory and performance - Memory technology. Types of storage devices - Buses - RAID - Reliability, availability and dependability - I/O performance measures - Designing an I/O system.

**Unit 3**

Multi-Core Architectures: Software and hardware multithreading - SMT and CMP architectures - Design issues - Case studies - Intel Multi-core architecture - SUN CMP architecture - heterogeneous multi-core processors - case study: IBM Cell Processor.

**TEXTBOOK:**

John L. Hennessy and David A. Patterson, "Computer architecture - A Quantitative approach", Morgan Kaufmann / Elsevier Publishers, Fifth edition, 2012.

**REFERENCES:**

1. David E. Culler and Jaswinder Pal Singh, "Parallel computing architecture: A hardware / software approach", Morgan Kaufmann, Elsevier Publishers, 1999.
2. Kai Hwang and Zhi-Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, New Delhi, 2003.

**15CSE333 ADVANCED DATABASE MANAGEMENT SYSTEMS 2 0 2 3****Unit 1**

Overview of DBMS - Database design - Query processing. Data modeling - ER - EER - Object Oriented Databases - Object Relational Databases, Document oriented Databases - Background of NoSQL - XML document - Structure of XML Data - XML Document Schema - Querying and Transformation - API - Storage of XML Data - XML Applications.

**Unit 2**

Information Retrieval Systems, Databases - Multidimensional Indexes - Data Cubes, Grid Files, R-trees.

**Unit 3**

Distributed Databases – Data Distribution – Distributed Transactions, Parallel Databases – Performance measure - Parallel operations for relational operations, Information Integration – Federated Database – Data Warehouses – Mediators – Schema matching methods.

**TEXTBOOK:**

Silberschatz, Korth and Sudarshan, "Database Concepts", Sixth Edition, Tata McGraw Hill, 2010.

**REFERENCES:**

1. Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, "Database Systems: The Complete Book", Pearson, 2011.
2. Niall O'Higgins, "Mongo D B and Python", O'reilly, 2011.

**15CSE334****BIG DATA ANALYTICS****3 0 0 3****Unit 1**

Introduction to Big Data: Types of Digital Data-Characteristics of Data – Evolution of Big Data - Definition of Big Data - Challenges with Big Data - 3Vs of Big Data - Non Definitional traits of Big Data - Business Intelligence vs. Big Data - Data warehouse and Hadoop environment - Coexistence. Big Data Analytics: Classification of analytics - Data Science - Terminologies in Big Data - CAP Theorem - BASE Concept. NoSQL: Types of Databases – Advantages – NewSQL - SQL vs. NOSQL vs NewSQL. Introduction to Hadoop: Features – Advantages – Versions - Overview of Hadoop Eco systems - Hadoop distributions - Hadoop vs. SQL – RDBMS vs. Hadoop - Hadoop Components – Architecture – HDFS - Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting - Compression. Hadoop 2 (YARN): Architecture - Interacting with Hadoop Eco systems.

**Unit 2**

No SQL databases: Mongo DB: Introduction – Features - Data types - Mongo DB Query language - CRUD operations – Arrays - Functions: Count – Sort – Limit – Skip – Aggregate - Map Reduce. Cursors – Indexes - Mongo Import – Mongo Export. Cassandra: Introduction – Features - Data types – CQLSH - Key spaces - CRUD operations – Collections – Counter – TTL - Alter commands - Import and Export - Querying System tables.

**Unit 3**

Hadoop Eco systems: Hive – Architecture - data type - File format – HQL – SerDe - User defined functions - Pig: Features – Anatomy - Pig on Hadoop - Pig Philosophy - Pig Latin overview - Data types - Running pig - Execution modes of Pig - HDFS commands - Relational operators - Eval Functions - Complex data type - Piggy Bank - User defined Functions - Parameter substitution - Diagnostic operator.

Jasper Report: Introduction - Connecting to Mongo DB - Connecting to Cassandra - Introduction to Machine learning: Linear Regression – Clustering - Collaborative filtering - Association rule mining - Decision tree.

**TEXTBOOK:**

Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.

**REFERENCES:**

1. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies", John Wiley & Sons, Inc., 2013.
2. Tom White, "Hadoop: The Definitive Guide", O'Reilly Publications, 2011.
3. Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012.
4. Russell Bradberry, Eric Blow, "Practical Cassandra A developers Approach", Pearson Education, 2014.

**15CSE335****BIOINFORMATICS****3 0 0 3****Unit 1**

Introduction: The Central Dogma – Killer Application – Parallel Universes – Watson's Definition – Top-Down vs Bottom-Up Approach – Information Flow – Conversance – Communications. Database and Networks: Definition – Data Management – Data Life Cycle – Database Technology – Interfaces – Implementation – Networks: Communication Models – Transmission Technology – Protocols – Bandwidth – Topology – Contents – Security – Ownership – Implementation.

**Unit 2**

Search Engines and Data Visualization: Search Process – Technologies – Searching and Information Theory – Computational Methods – Knowledge Management – Sequence Visualizations – Structure Visualizations – User Interfaces – Animation vs Simulation. Statistics, Data Mining and Pattern Matching: Statistical Concepts – Micro Arrays – Imperfect Data – Basics – Quantifying – Randomness – Data Analysis – Tools Selection – Alignment – Clustering – Classification – Data Mining Methods – Technology – Infrastructure Pattern Recognition – Discovery.

**Unit 3**

Machine Learning – Text Mining – Pattern Matching Fundamentals – Dot Matrix Analysis – Substitution Matrix – Dynamic Programming – Word Method – Bayesian Method – Multiple Sequence Alignment Tools. Modelling Simulation and Collaboration: Drug Discovery Fundamentals – Protein Structure – System Biology Tools – Collaboration and Communication – Standards – Issues – Case Study.

**TEXTBOOK:**

Bergeron B, "Bio Informatics Computing", Prentice Hall, 2003.

**REFERENCES:**

1. Affward T K and Smith D J P, "Introduction to Bio Informatics", Pearson Education, 2001.
2. Baldi P and Brunak S, "Bio Informatics - The Machine Learning Approach", Second Edition, First East West Press, 2003.

**15CSE336****BIOMETRICS****3 0 0 3****Unit 1**

Introduction - Biometric fundamentals – Biometric technologies – Biometrics vs traditional techniques – Characteristics of a good biometric system – Benefits of biometrics – Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems.

**Unit 2**

Physiological Biometrics - Leading technologies: Finger-scan – Facial-scan – Iris-scan – Voice-scan – components, working principles, competing technologies, strengths and weaknesses – Other physiological biometrics: Hand-scan, Retina-scan – components, working principles, competing technologies, strengths and weaknesses – Automated fingerprint identification systems. Behavioural Biometrics: Leading technologies: Signature-scan – Keystrokescan – components, working principles, strengths and weaknesses.

**Unit 3**

Standards in Biometrics - Assessing the Privacy Risks of Biometrics – Designing Privacy - Sympathetic Biometric Systems – Need for standards – different biometric standards - Categorizing biometric applications.

**TEXTBOOK:**

Anil K Jain, Patrick Flynn, and Arun A Ross, "Handbook of Biometrics", Springer, 2008.

**REFERENCES:**

1. Paul Reid, Samir Nanavati, Michael Thieme and Raj Nanavati, "Biometrics – Identity Verification in a Networked World", Wiley-Dream Tech India Private Limited, New Delhi, 2003.
2. John R Vacca, "Biometric Technologies and Verification Systems", Elsevier Inc, 2007

**15CSE337****CLOUD COMPUTING AND SERVICES****3 0 0 3****Unit 1**

Introduction - Cloud computing at a Glance – Historical Development – Building Cloud Computing Environments – Computing Platform and Technologies – Principles of Parallel and Distributed Computing - Elements of parallel and Distributed Computing.

**Unit 2**

Virtualization and Cloud Computing Architecture: Introduction - Characteristic of Virtualized Environments – Taxonomy of Virtualization Techniques - Virtualization and Cloud Computing – Technology Examples - Cloud reference model – Types of the Cloud.

**Unit 3**

Cloud Application Platform and Thread Programming - Anatomy of the Aneka Container – Building Aneka Clouds – Cloud Programming and Management – Programming Applications with Threads – Multithreading and Programming Applications with Aneka Threads, Applications: Amazon Web Applications – Google App Engine – Microsoft Azure – Scientific Applications – Business and Consumer Applications - Third Party Cloud Services.

**TEXTBOOK:**

Rajkumar Buyya, Christian Vecchiola and Thamari Selvi S, "Mastering in Cloud Computing", McGraw Hill Education (India) Private Limited, 2013.

**REFERENCES:**

1. Anthony T Velte, "Cloud Computing: A practical Approach", Tata McGraw Hill, 2009.
2. Halper Fern, Kaufman Marcia, Bloor Robin and Hurwit Judith, "Cloud Computing for Dummies", Wiley India, 2009.
3. Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2009.

**15CSE338****COMPUTATIONAL INTELLIGENCE****3 0 0 3****Unit 1**

Artificial Intelligence – a brief review – Pitfalls of traditional AI – Why Computational Intelligence? – Computational intelligence concept - Importance of tolerance of imprecision and uncertainty - Constituent techniques – Overview of Artificial Neural Networks, Fuzzy Logic, Evolutionary Computation.

**Unit 2**

Neural Network: Biological and artificial neuron, neural networks, supervised and unsupervised learning. Single layer Perceptron, Multilayer Perceptron – Back propagation learning. Neural networks as associative memories - Hopfield networks, Bidirectional Associative Memory. Topologically organized neural networks – competitive learning, kohonen maps.

**Unit 3**

Fuzzy Logic: Fuzzy sets, properties, membership functions, fuzzy operations. Fuzzy logic and fuzzy inference and applications, Evolutionary Computation - constituent algorithms, Swarm intelligence algorithms - Overview of other bio-

inspired algorithms - Hybrid approaches (neural networks, fuzzy logic, genetic algorithms etc.)

**TEXTBOOKS:**

1. Kumar S, "Neural Networks - A Classroom Approach", Tata McGraw Hill, 2004.
2. Konar. A, "Computational Intelligence: Principles, Techniques and Applications", Springer Verlag, 2005

**REFERENCES:**

1. Engelbrecht, A.P, "Fundamentals of Computational Swarm Intelligence", John Wiley & Sons, 2006.
2. Ross T J, "Fuzzy Logic with Engineering Applications", McGraw Hill, 2002.
3. Eiben A E and Smith J E, "Introduction to Evolutionary Computing", Second Edition, Springer, Natural Computing Series, 2007.
4. Jang J S R and Sun C T, Mizutani E, "Neuro - Fuzzy and Soft Computing", PHI, 2002.
5. Rajashekar S and Vijayalakshmi Pai G A, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.

**15CSE339 COMPUTER SYSTEMS ENGINEERING 3 0 0 3**

**Unit 1**

Introduction to systems - Complexity in computer systems -Abstractions and naming - Modularity with client / server - Operating system structure - Clients and servers within a computer - Virtualizing processors: threads – Performance.

**Unit 2**

Introduction to networks - Layering and link layer - Network layer, routing - End-to-end layer - Congestion control - Distributed naming - Reliability - Atomicity concepts - Recoverability – Isolation

**Unit 3**

Multi-site atomicity - Consistency and replication - Security intro - Authentication - Cryptographic protocols - Authorization and confidentiality - Systems design experience – Complexity.

**TEXTBOOKS:**

1. Saltzer, Jerome H and Kaashoek M F, "Principles of Computer System Design: An Introduction, Part I", Morgan Kaufmann, 2009.
2. Saltzer, Jerome H and Kaashoek M F, "Principles of Computer System Design: An Introduction, Part II", from MIT Open Courseware, 2009.

**REFERENCES:**

1. Brooks and Frederick P Jr, "The Mythical Man-Month", Addison-Wesley, 1995.

**15CSE340 COMPUTER VISION 3 0 0 3**

**Unit 1**

Introduction, Image Formation – geometric primitives and transformations, photometric image formation, digital camera, Image Processing – point operators, linear filtering, neighbourhood operators, fourier transforms, segmentation.

**Unit 2**

Feature Detection and Matching – points and patches, edges, lines, Feature-based Alignment - 2D, 3D feature-based alignment, pose estimation, Image Stitching, Dense motion estimation – Optical flow - layered motion, parametric motion, Structure from Motion.

**Unit 3**

Recognition - object detection, face recognition, instance recognition, category recognition, Stereo Correspondence – Epipolar geometry, correspondence, 3D reconstruction.

**TEXTBOOK:**

Szeliski R, "Computer Vision: Algorithms and Applications", Springer, 2010.

**REFERENCES:**

1. Shapiro L G and Stockman G., "Computer Vision", Prentice Hall, 2001.
2. Forsyth D A and Ponce J, "Computer Vision – A Modern Approach", Second Edition, Pearson Education, 2012.
3. Davies E.R, "Machine Vision: Theory, Algorithms, Practicalities", Morgan Kaufmann, 2004.
4. Jain R, Kasturi R and Shunck B G, "Machine Vision", McGraw Hill, 1995.

**15CSE341 CRYPTOGRAPHY 3 0 0 3**

**Unit 1**

Basics of Number theory - Integers and Operations on Integers - Modular arithmetic - Prime Numbers – Primality related properties and Algorithms - Pseudo Random Number Generation. Classical Cryptography: Basic conventions and Terminology - Substitution Ciphers -Transposition ciphers - Rotor machines - Cryptanalysis.

**Unit 2**

Foundations of Modern Cryptography - Perfect Secrecy - Information and Entropy - Source Coding, Channel Coding, and Cryptography - Product cryptosystems. Symmetric Cryptosystems: Substitution permutation networks DES and Enhancements - AES and its Modes. Asymmetric Key Cryptography: Basic Ideas of Asymmetric Key Cryptography - RSA Cryptosystem.



**Unit 3**

Primality Testing - Square root modulo m-Factorization Algorithms - Attacks on RSA - Rabin Cryptosystem - Discrete Logarithm Problem and related Algorithms - ElGamal Cryptosystem - Introduction to Elliptic Curve Cryptography - Hash Functions and Message Authentication: Data Integrity - Security of Hash functions - Iterated Hash Functions - Message Authentication.

**TEXTBOOK:**

Padmanabhan T R, Shyamala C K and Harini N, "Cryptography and Security", First Edition, Wiley Publications, 2011.

**REFERENCES:**

1. Stallings W, "Cryptography and Network Security", Third Edition, Pearson Education Asia, Prentice Hall, 2000.
2. Forouzan B A, "Cryptography and Network Security", Special Indian Edition, Tata McGraw Hill, 2007

**15CSE342****DATA COMPRESSION****3 0 0 3****Unit 1**

Information theoretic foundations: Lossless and lossy compression, Modelling and coding Entropy, conditional entropy, information, channels, Data models: static and adaptive, coding: Fano, Huffman, Golomb, Rice, Tunstall Arithmetic coding: Encoding, Decoding, Adaptation, Dictionary techniques: Static techniques.

**Unit 2**

Adaptive coding: the LZ family. Context modelling: PPM, Burrows-Wheeler, Move-to front, DMC. Lossless image compression: Multiresolution, CCITT Group 3 and 4, JBIG, JBIG2. Lossy coding preliminaries: Distortion, Rate distortion, linear system models. Scalar and vector quantization: Uniform and non-uniform quantizers, Adaptive quantization, Lloyd-Max quantizer.

**Unit 3**

Differential encoding: Predictive DPCM, Adaptive DPCM. Transform coding: Bases, inner products, orthogonality and orthonormality, Karhunen-Loève transform, DCT, Walsh-Hadamard transform, JPEG

**TEXTBOOK:**

David Salomon and Giovanni Motta, "Handbook of Data Compression", Fifth Edition, Springer, 2010.

**REFERENCES:**

1. David Salomon, "Data compression: the complete reference", Third Edition, New York: Springer, 2004.
2. Sayood, Khalid, "Introduction to Data Compression", Third Edition, Morgan Kaufmann, 2006.

**15CSE343****DESIGN PATTERNS****3 0 0 3****Unit 1**

Introduction to Design Patterns: Significance – Software Design and patterns – Model – View - Controller.

**Unit 2**

Observer Pattern - Decorator Pattern - Factory Pattern - Singleton Pattern - Command Pattern - Adapter and Facade Patterns - Template

Method Pattern - Iterator and Composite Patterns – The State Pattern – The Proxy Pattern – Compound Patterns.

**Unit 3**

GRASP Patterns and Anti-patterns. Case Study: Use of patterns in the Design of a Modern Web Framework.

**TEXTBOOK:**

Erich Freeman, Elisabeth Robson, Bert Bates and Kathy Sierra "Head First Design Patterns", O'Reilly Media Inc., October 2004.

**REFERENCES:**

1. Erich Gamma, Richard Helm, Ralph Johnson and John M. Vlissides, "Design Patterns: Elements of Reusable Object Oriented Software", Second Edition, Addison Wesley, 2000
2. James W. Cooper, "Java Design Patterns: A Tutorial", Second Edition, Pearson Education, 2003.
3. Mark Grand, "Patterns in Java – A Catalog of Reusable Patterns Illustrated with UML", Second Edition, Wiley – Dream tech India, 2002

**15CSE344****DIGITAL WATERMARKING****3 0 0 3****Unit 1**

Introduction - Applications and Properties: Applications – Properties – Evaluating watermarking systems, Models of Watermarking: Communication based watermarking – Geometric models of watermarking – Modelling watermarks detection by correlation.

**Unit 2**

Watermarking with side information: Informed embedding – informed coding – dirty paper codes.

**Unit 3**

Perceptual Models: Evaluation – Perceptual model – Watson's model – Adaptive watermarking. Robust watermarking – Watermark Security Secret Writing and Steganography – Watermarking for Copyright Protection.

**TEXTBOOK:**

Ingemar Cox, Matthew Miller, Jeffrey Bloom, Mathew Miller, "Digital Watermarking: Principles and Practice", Morgan Kaufmann Series in Multimedia Information and Systems, 2008.

**REFERENCES:**

1. Stefan Katzenbeisser, Fabien A. P. Petitcolas, "Information Hiding Techniques for Steganography and Digital Watermarking", Artech House, 2000.
2. Frank Y. Shih, "Digital Watermarking and Steganography: Fundamentals and Techniques", CRC Press, USA, 2007.
3. Juergen Seitz, "Digital Watermarking for Digital Media", IGI Global, 2005.

**15CSE345 DISTRIBUTED EMBEDDED SYSTEMS 3 0 0 3****Unit 1**

Parallels between the large-scale (Internet-based) and small-scale networked distributed embedded system domains.

**Unit 2**

Topics in distributed embedded systems: real-time systems, models, communication and scheduling, design and validation, implementation, performance, power and cost, embedded network protocols.

**Unit 3**

Basics of embedded system security, distributed cyber physical systems that includes integration of protocols, middleware services, and tools into a common architecture with layered, reusable, secure, fault-isolating components, project case studies for distributed embedded systems

**TEXTBOOK:**

Hermann Kopetz, "Real-Time Systems - Design Principles for Distributed Embedded Applications", Springer, Second Edition, 2011.

**REFERENCES:**

1. Phillip Koopman, "Better Embedded Software", Drumnadrochit Education, 2010.
2. Steve Heath, "Embedded System Design", Newnes, 2003.
3. Peter Marwedel, "Embedded System Design - Embedded System Design Foundations of Cyber - Physical Systems", Springer, Second edition, 2011.
4. Wayne Wolf, "Computers as Components", Second edition, Morgan Kaufmann, 2008.

**15CSE346 EMBEDDED PROGRAMMING 2 0 2 3****Unit 1**

Basics of Embedded Systems – Definition, Characteristics, Challenges, Embedded Programming Concepts: Role of Infinite loop – Compiling, Linking and locating,

Efficient compilation examples – downloading and debugging – Emulator and simulator processors – External peripherals – Memory testing – Flash Memory.

**Unit 2**

Operating System: Embedded operating systems – Real time characteristics – Selection process – Flashing the LED – serial ports – code efficiency – Code size – Reducing memory usage – Impact of object oriented programming.

Hardware Fundamentals: Buses – DMA – interrupts – Built-ins on the microprocessor – Conventions used on schematics – Microprocessor Architectures – Software Architectures – RTOS Architectures – Selection of Architecture. RTOS Tasks and Task states – System V IPC mechanisms – Memory management – Interrupt routines – Encapsulating semaphore and queues – Hard Real-time scheduling – Power saving.

**Unit 3**

Embedded Software Development Tools: Host and target machines – Linkers / Locators for Embedded Software – Debugging techniques – Instruction set simulators Laboratory tools – Practical example – Source code. Case study on Portable computing platforms.

**TEXTBOOKS:**

1. Michael Barr, Anthony Massa "Programming Embedded Systems, Second edition With C and GNU Development Tools", O'reilly Media Oct, 2006.
2. David E. Simon, "An Embedded Software Primer", Pearson Education, 2003.
3. Michael Barr, "Programming Embedded Systems in C and C++", O'Reilly, 2003.

**REFERENCES:**

1. Sriramlyer and Pankaj Gupta, "Embedded Real time Systems Programming", Tata McGraw Hill Publications, First Edition, 2011.
2. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw Hill, 2008.
3. Lewis Daniel W, "Fundamentals of Embedded Software: Where C and Assembly Meet", Prentice Hall, 2003.

**15CSE347 ENTERPRISE ARCHITECTURE 3 0 0 3****Unit 1**

Enterprise architecture (EA) principles and purpose; modelling approaches for EA definition and communication; key enterprise architecture approaches, standards, and frameworks; best practice for development of enterprise architecture, analysis of alternative models for enterprise architectures; best practice approaches and models for documenting enterprise architectures.

**Unit 2**

Evaluation of alternative enterprise architecture approaches, identification and evaluation of gaps and opportunities in different enterprise architecture models and processes; models of different aspects of the enterprise architecture processes and artefacts, and architectures at different levels, including conceptual and technical.

**Unit 3**

Cloud Computing: The internet as a platform, Software as a service and cloud computing, cloud computing platforms, Cloud Technologies – Web Services – SOAP - AJAX, Virtualization and cloud, Mutitenant Software, Data in the cloud and cloud file systems, Big Data: Map Reduce, Hadoop.

**TEXTBOOKS:**

1. Scott A. Bernard, and Author house, "An Introduction to Enterprise Architecture", Second Edition, Author House, 2005.

**REFERENCES:**

1. Gautam Shroff "Enterprise Cloud Computing: Technology, Architecture, Applications", Cambridge University Press, 2010.
2. Dan C Marinescu, "Cloud Computing: Theory and Practice", Morgan Kaufmann, 2013.
3. Sitaram and Manjunath, "Moving to the Cloud", Elsevier, 2012.
4. Tom White, "Hadoop: The Definitive Guide", O'Reilly Media, 2012.

**15CSE348****HUMAN COMPUTER INTERFACE****2 0 2 3****Unit 1**

Introduction to Interaction Design: User Experience - The process of Interaction Design - Interaction design and User Experience. Understanding and Conceptualizing Interaction: Conceptual Models - Interface Metaphors - Interaction Types - Paradigms and Frameworks. Cognitive Aspects: Cognition - Cognitive Framework. Social Interaction – Emotional Interaction.

**Unit 2**

Interfaces: Types - Natural User Interfaces, Data Gathering: Key Issues - Data Recording – Interviews – Questionnaires – Observation - Choosing and Combining Technique. Data Analysis, Interpretation and Presentation: Qualitative and Quantitative – Simple Analysis – Tools -Theoretical Frameworks - Presenting the Findings.

**Unit 3**

Process of Interaction Design: Introduction. Establishing Requirements: Data Gathering for Requirements - Task Description - Task Analysis, Design, Prototyping and Construction: Prototyping and Construction - Conceptual Design and Physical

Design - Using Scenarios, Prototypes in Design. Evaluation: Introduction - Evaluation Framework.

**TEXTBOOK:**

Sharp, H., Rogers, Y., and Preece, J, "Interaction Design: Beyond Human – Computer Interaction", Third Edition, John Wiley & Sons, Inc., 2011.

**REFERENCES:**

1. Alan Dix, Janet E. Finlay, Gregory D. Abowd and Russell Beale, "Human – Computer Interaction", Pearson Education, Third Edition, 2004.
2. Wilbert O. Galitz, "The Essential Guide to User Interface Design: An Introduction to Gui Design Principles and Techniques", Third Edition, John Wiley Sons, 2002.
3. Benyon, D., Turner, P., and Turner, S, "Designing Interactive Systems: People, Activities, Contexts, and Technologies", Addison-Wesley, 2005.

**15CSE349****INFORMATION CODING TECHNIQUES****3 0 0 3****Unit 1**

Source Coding: Information theory, Uncertainty and information, entropy, source coding theorem, Huffman coding, Lempel-Ziv algorithm, Arithmetic coding. Channel capacity and coding: Channel models, channel capacity, channel coding; Information capacity theorem, Shannon limit.

**Unit 2**

Linear block codes for error correction: Introduction to Error correcting codes, matrix description of linear block codes, equivalent codes, parity check matrix, decoding of linear block code, Syndrome decoding, perfect codes, Hamming codes, Optimal linear codes, MDS codes.

**Unit 3**

Cyclic Codes: Introduction to cyclic codes, Polynomials, division algorithm for polynomials, method for generating cyclic codes, matrix description, generator polynomial, matrix description Bose-Chaudhuri Hocquenghem (BCH) codes: Introduction to BCH codes, primitive elements, minimal polynomials, generator polynomials, examples Decoding of BCH codes, Reed Solomon codes.

**TEXTBOOK:**

Ranjan B, "Information Theory, Coding, and Cryptography", Second Edition, Tata McGraw Hill, New Delhi, 2008.

**REFERENCE:**

Shu Lin, Daniel J. Costello, "Error Control Coding: Fundamentals and Applications", Second Edition, Pearson-prentice Hall, 2004.

**15CSE350 INFORMATION RETRIEVAL 3 0 0 3**

**Unit 1**

Boolean Retrieval – The term vocabulary and postings lists – Dictionaries and tolerant retrieval – Index Construction. Index Compression – Scoring, term weighting and the vector space model – Computing Scores in a complete search system – Evaluation in information retrieval.

**Unit 2**

Relevance feedback and query expansion – XML retrieval – Probabilistic Information retrieval, Text classification and Naive Bayes – Vector space classification – Flat Clustering – Matrix decompositions and latent semantic indexing.

**Unit 3**

Web search basics – Web crawling and indexes – Link analysis.

**TEXTBOOK:**

*Manning C D, Raghavan P and Schütze H, "Introduction to Information Retrieval", Cambridge University Press, 2008*

**REFERENCES:**

1. Rijsbergen C J, "Information Retrieval", Second Edition, Butterworths, 1979.
2. Grossman D A and Frieder O, "Information Retrieval: Algorithms and Heuristics", Second Edition, Springer, 2004.
3. Kowalski G and Maybury M T, "Information Storage and Retrieval Systems", Second Edition, Springer, 2000.

**15CSE351 INFORMATION SECURITY 3 0 0 3**

**Unit 1**

Digital Signature and Authentication Schemes: Digital signature - Digital Signature Schemes and their Variants - Digital Signature Standards - Authentication: Overview - Requirements Protocols - Applications - Kerberos - X.509 Directory Services.

**Unit 2**

Electronic mail security: Email Architecture - PGP – Operational Descriptions - Key management - Trust Model - S/MIME. IP Security: Overview - Architecture - ESP, AH Protocols IPsec Modes – Security association - Key management.

**Unit 3**

Web Security: Requirements - Secure Sockets Layer – Objectives - Layers - SSL secure communication - Protocols - Transport Level Security. Secure Electronic Transaction - Entities DS Verification - SET processing.

**TEXTBOOK:**

*Padmanabhan T R, Shyamala C K and Harini N, "Cryptography and Security", First Edition, Wiley India Publications, 2011.*

**REFERENCES:**

1. Stallings W, "Cryptography and Network Security", Third Edition, Pearson Education Asia. Prentice Hall, 2000.
2. Forouzan B A, "Cryptography and Network Security", Special Indian Edition, Tata McGraw Hill, 2007.

**15CSE352 INTELLIGENT SYSTEMS 3 0 0 3**

**Unit 1**

Introduction to agents – Structure of intelligent agents, Problem solving agents – Formulating problems – Overview of uninformed searching strategies, informed search methods, Game playing as search.

**Unit 2**

Knowledge based agent representation - Logics – First Order logic – Reflex agents – Building a knowledge base – General ontology – Inference – Logical recovery. Planning agents – Planning in situational calculus – Representation of Planning – Partial order Planning – Practical Planners – Conditional Planning.

**Unit 3**

Agents acting under uncertainty - probability notation - Bayes rule, Probabilistic reasoning - Belief networks – Utility theory - Decision network - Value of information learning agents – Learning from Observations – Knowledge in Learning, Case studies on applications of AI.

**TEXTBOOK:**

*Russell S and Norvig P, "Artificial Intelligence – A modern approach", Third Edition, Prentice Hall, 2009.*

**REFERENCES:**

1. Elaine Rich, Kevin Knight and Shivashankar B. Nair, "Artificial Intelligence", Third Edition, TMH Educations Private Limited, 2008.
2. Nilsson N J, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.

**15CSE353 INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS 3 0 0 3**

**Unit 1**

Introduction to IPR - Overview & Importance, IPR in India and IPR abroad; Patents - their definition, granting, infringement, searching & filing, utility Models an introduction; Copyrights - their definition, granting, infringement, searching & filing, distinction between related and copy rights.

**Unit 2**

Trademarks - role in commerce, importance, protection, registration, domain names; Industrial Designs - Design Patents, scope, protection, filing infringement, difference between Designs & Patents.

**Unit 3**

Geographical indications, international protection; Plant varieties; breeder's rights, protection; biotechnology & research and rights managements; licensing, commercialisation; legal issues, enforcement; Case studies in IPR.

**TEXTBOOK:**

James Boyle and Jennifer Jenkins, "Intellectual Property Law and the Information Society", Published by Duke University, 2014.

**15CSE355****MODELLING AND SIMULATION****3 0 0 3****Unit 1**

Principle of computer modeling and simulation, Monte Carlo simulation. Nature of computer modelling and simulation. Limitations of simulation, areas of application. System and environment – components of a system – Discrete and continuous systems. Models of a system – A variety of modelling approaches.

**Unit 2**

Random number generation, technique for generating random numbers – Midsquare method – The midproduct method – Constant multiplier technique – Additive congruential method – Linear congruencies method – Tests for random number – The Kolmogorov Smirnov test – The chi-square test. Random variable generation – Inverse transform technique – Exponential distribution – Uniform distribution – Weibull distribution, empirical continuous distribution – Generating approximate normal variates. Empirical discrete distribution – Discrete uniform distribution – Poisson distribution – Geometric distribution – Acceptance – Rejection technique for Poisson distribution – Gamma distribution.

**Unit 3**

Design and evaluation of simulation experiments – Input – Output analysis – Variance reduction technique – Verification and validation of simulation models. Discrete event simulation – Concepts in discrete – event simulation – Manual simulation using event scheduling, single channel queue, two server queue, simulation of inventory problems. Simulation languages – GPSS – SIMSCRIPT – SIMULA – Programming for discrete event systems in GPSS and C. Case Study: Simulation of LAN – Manufacturing system – Hospital management system.

**REFERENCES:**

1. Jerry Banks and John S. Carson, "Discrete Event System Simulation", Fifth Edition, Prentice Hall Inc, 2009.
2. Narsingh Deo, "System Simulation with Digital Computer", Prentice Hall of India, 1979.
3. Francis Neelamkovil, "Computer Simulation and Modeling", John Wiley & Sons, 1987.
4. Averil M. Law and W. David Kelton, "Simulation Modeling and Analysis", McGraw Hill International Editions, 1991.

**15CSE356****MULTIMEDIA DATABASES****2 0 2 3****Unit 1**

Introduction: An introduction to Multimedia Databases – Need for MMDB – Metadata based and Content based Retrieval. Object Oriented and Object Relational Databases: Object Relational Database – Object-Oriented Databases – Data Models – Queries over such databases.

**Unit 2**

Architectures for MMDB: Architecture requirements - multimedia server design - distributed multimedia servers - client server architecture - peer-to-peer systems  
Metadata for MMDB: Features of Metadata - Types of Metadata - Metadata for Text, Images, Audio, Video - Annotation, generation and extraction – standards  
Multimedia Query Processing: Data Manipulation - Transaction Management – Query Processing - Query language issues - SQL for Multimedia Queries. Storage Management: Access Methods and Indexing - Quad tree – R-Trees Storage Methods (Striping, RAID etc).

**Unit 3**

Image Databases: Overview - Representing Image DB with Relations and R-Trees - Overview of Image Retrieval and Mining - Similarity Based Retrieval - Metric Approach Text Databases: Overview – Processing and Indexing Text Data - Inverted indices - overview of text retrieval / mining - Boolean Retrieval – Vector based Retrieval – Semantic Retrieval. Video Databases: Organizing content of a single video - overview of video and audio mining - query languages for videos - indexing video content – r-segment trees  
Multimedia DB: Mining combinations of data, architectures (only high level overview), Performance issues – Visualization of Multimedia Data.

**TEXTBOOK:**

Subhranian V S, "Principles of Multimedia Database Systems", Morgan Kaufmann Publisher, 2001.

**REFERENCES:**

1. Lynne Dunckley, "Multimedia Databases: An Object - Relational Approach", Pearson Education, 2003.

2. Khoshafian, "Multimedia and Imaging Databases", Lavoisier Publications, 1997.
3. Bhavani Thurasingham, "Managing and Mining Multimedia Databases", CRC Press, 2001.
4. J. K. Wu, M. S. Kankanhalli, J. H. Lim and D. Z. Hong, "Perspectives on Content based Multimedia Systems", Kluwer Academic Publishers, 2000.

### 15CSE357      **NAND2TETRIS: BUILDING COMPUTERS      2 0 2 3** **FROM FIRST PRINCIPLES**

#### Unit 1

Hello World Below: Abstraction, Implementation Paradigm – HDL Overview – Implementing Gates in HDL – Combinational Logic: Design and Implement Binary Adders – Simple ALU Construction – Sequential Logic: Design and Implementation of Memory Hierarchy – Implementing Flip Flop Gates, Registers and RAM units of Arbitrary Sizes – Machine Language: Instruction Set (Binary and Assembly Versions) – Writing Low-level Assembly Programs – Running on CPU Emulator.

#### Unit 2

Computer Architecture: Integrating Chip-sets – Building an Assembler – Virtual Machine I: Implementing a VM to translate from VM language into assembly language – Virtual Machine II: Complete VM implementation as the back-end component of Compiler.

#### Unit 3

High Level Language: Introduction to Jack a high-level object-based language – Compiler I: Building a Syntax analyzer for Jack – Compiler II: Morphing syntax analyzer into a full-scale compiler – Operating System: Design and Implementation of some classical arithmetic and geometric algorithms needed for OS implementation.

#### TEXTBOOK:

Noam Nisan and Shimon Schocken, "The Elements of Computing Systems – Building Modern Computers from First Principles", MIT Press, 2008.

#### REFERENCES:

3. Edward G. Amoroso and Matthew E. Amoroso, "From Gates to Apps", Silicon Press, 2013.
4. Roger Young, "How Computers Work: Processor and Main Memory", Create space Independent Publishing Platform, Second Edition, 2009.
5. Charles Petzold, "Code: The Hidden Language of Hardware and Software", Microsoft Press, 2000.

### 15CSE358      **NATURAL LANGUAGE PROCESSING      3 0 0 3**

#### Unit 1

Introduction: Words – Morphology and Finite State transducers - Computational Phonology and Pronunciation Modelling - Probabilistic models of pronunciation and

spelling – Ngram Models of syntax - Hidden markov models and Speech recognition - Word classes and Part of Speech Tagging.

#### Unit 2

Context free Grammars for English – Parsing with Context free Grammar – Features and unification - Lexicalized and Probabilistic Parsing -Language and Complexity. Semantics: Representing meaning - Semantic analysis - Lexical semantics - Word sense disambiguation and Information retrieval.

#### Unit 3

Pragmatics: Discourse - Dialog and Conversational agents - Natural language generation, Statistical alignment and Machine translation: Text alignment – word alignment – statistical machine translation.

#### TEXTBOOK:

Daniel and Martin J H, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2009.

#### REFERENCES:

1. Manning C D and Schutze H, "Foundations of Statistical Natural Language processing", First Edition, MIT Press, 1999.
2. Allen J, "Natural Language Understanding", Second Edition, Pearson Education, 2003.

### 15CSE259      **OS FOR SMART DEVICES (ANDROID AND IOS)      2 0 2 3**

#### Unit 1

iOS: Top down view of iOS – System Start-up Procedure iBoot – Processes - Threads – virtual memory - File Systems – Security Architecture - Internal API used by the system - BSD and Mach- Dissecting the kernel, XNU, into its sub components: Mach, the BSD Layer, and I/o kit - Inner workings of device drivers. Objective C – Swift Programming - Xcode, Cocoa Touch API, memory management, user input and gesture recognition, data persistence including Core Data, SQLite, NSUserDefaults and Plists. Working with audio, video and the accelerometer. Simple Applications development.

#### Unit 2

Android: Introduction - Introduction to the Linux kernel - Compiling and booting the Linux kernel - Understanding the Android Internals - Understanding the Android Build System - Customizing Android for a specific hardware - Building and booting Android.

Android changes to the Linux kernel - Android boot-loaders - Booting Android - Using ADB - Android file-system. Android build system - Adding a new module and

product. Android native layer - Bionic, Toolbox, init, various daemons, Dalvik, hardware abstraction, JNI

### Unit 3

Android framework for applications - Introduction to application development - Android packages - Advice and resources -Application ecosystem - web technologies in Mobile OS - Hardware accelerated graphics through OpenGL ES - ANDROID support for all the common wireless mechanisms: GSM, CDMA, UMTS, LTE, Bluetooth, WiFi, NFC.

Case Study: Extending the Android framework for ARM-based hardware.

#### TEXTBOOKS:

1. Jonathan Levin, "MAC OS X and iOS internals: to the Apple's Core", Wiley / Wrox Tile, 2012.
2. Ole Henry Halvorsen and Douglas Clarke, "OS X and iOS Kernel Programming", First Edition, Apress Publication, 2011.

#### REFERENCES:

1. Karim Yaghmour, "Embedded Android: Porting, Extending and Customizing", O'Reilly Publications, 2013.
2. Earlene Fernandes, "Instant Android Systems Development How To", PACKT Publishing, 2013.

## 15CSE360 PARALLEL AND DISTRIBUTED COMPUTING 3 0 0 3

### Unit 1

Introduction: The Reality of High Performance Computing - Modern Algorithms – Compilers - Scientific Algorithms – History - State-of-Art and Perspective - Things that are not Traditional Supercomputers. Parallel Computing - PDC models working mechanism - scalability of PDC architectures – applications, performance metrics and Amdahl's Law.

### Unit 2

Models and Algorithms - PRAM algorithms, Process-level parallelism, data-level parallelism, Problem partitioning, divide-and-conquer, Distributed algorithms – Algorithm design techniques - filters, client / server, heartbeat, probe / echo, token passing, replicated servers Communication - Interconnection network design, Topological and parametric models of interconnection networks; routing mechanisms; flow control mechanisms, communication protocols, Communication primitives - Point-to-point communication primitives; group communication patterns; broadcast in distributed systems, CSP, MPI; Synchronization - Locks, monitors, barriers; deadlock; hardware primitives and implementation issues; clock synchronization, distributed mutual exclusion; distribute deadlock detection.

### Unit 3

Computation: Threads - Creation, coordination, termination; futures. Shared Memory - Models of memory consistency; implementation of consistency protocols; transactions: serializability, concurrency - control, commit protocols; Linda. Scheduling and Load Balancing: Load distribution algorithms; task migration; co-scheduling; affinity scheduling; self-scheduling in loops.

#### TEXTBOOK:

Wilkinson B and Allen M, "Parallel Programming Techniques and Applications using Networked Workstations and Parallel Computer", Second Edition, Prentice Hall, Upper Saddle River, 2004.

#### REFERENCES:

1. Tanenbaum A, "Distributed Operating Systems", Prentice Hall, 1999
2. Nikhil R S and Arvind, "Implicit Parallel Programming in PH", Morgan Kaufman, 2001.

## 15CSE361 PATTERN RECOGNITION 3 0 0 3

### Unit 1

Introduction: Machine perception – Pattern recognition systems – Design cycle – Learning and adaptation - Bayesian decision theory - minimum error rate classification – discriminant functions – decision surfaces – normal density based discriminant functions - Maximum likelihood estimation – Bayesian estimation.

### Unit 2

Bayesian parameter estimation – Gaussian case – problems of dimensionality - Components analysis and discriminants – hidden Markov models, Non-parametric Techniques: density estimation – parzen windows – nearest neighbourhood estimation – linear discriminant functions and decision surfaces – two category linearly separable case – perception criterion function.

### Unit 3

Non-Metric Methods: decision trees – CART methods – algorithm independent machine learning- bias and variance – regression and classification - classifiers – Unsupervised learning and clustering – mixture densities and identifiably – hierarchical clustering – low dimensional representation – multidimensional scaling.

#### TEXTBOOK:

Duda R O, Hart P E and Stork D G, "Pattern Classification", Second Edition, John Wiley & Sons, 2003.

#### REFERENCES:

1. Gose E, Johnsonbaugh R and Jost S, "Pattern Recognition and Image Analysis", Prentice Hall of India, 2002.
2. Bishop C M, "Pattern Recognition and Machine Learning (Information Science and Statistics)", First Edition, Springer, 2006.
3. Bishop C M, "Neural networks for Pattern Recognition", Oxford University Press, 1995.

**15CSE362****PERVASIVE COMPUTING****3 0 0 3****Unit 1**

Basics: Some Computer Science Issues in Ubiquitous Computing, Pervasive Computing:

Vision and Challenges, Naming and Service Discovery: The Design and Implementation of an Intentional Naming System, Dealing with Location: Providing Location Information in a Ubiquitous Computing Environment, The Cricket Compass for Context-Aware Mobile Applications, Mobile Data Access: Balancing Push and Pull for Data Broadcast, Rover: A Toolkit for Mobile Information Access, Agile Application - Aware Adaptation for Mobile Computing, the Roma Personal Metadata Service, Consistency Management.

**Unit 2**

Mobile Networking: Scalable Support for Transparent Host Internetworking, A Comparison of Mechanisms for Improving TCP Performance over Wireless Networks, An End-to-End Approach to Host Mobility, Reliable Network Connections Distributed File Systems: Exploiting Weak Connectivity for Mobile File Access, Automated Hoarding for Mobile Computers, Personal RAID: Mobile Storage for Distributed and Disconnected Computers Energy Management.

**Unit 3**

Sensor Networks: Mobile Networking for "Smart Dust", Building Efficient Wireless Sensor Networks with Low-Level Naming, Fine-Grained Network Time Synchronization using Reference Broadcasts Security: The Resurrecting Duckling: Security Issues for Ad-Hoc Wireless Networks, Zero-Interaction Authentication, SPINS: Security Protocols for Sensor Networks, Toward Speech-Generated Cryptographic Keys on Resource-Constrained Devices.

**TEXTBOOK:**

Jochen Burkhardt, Dr Horst Henn, Stefan Hepper, Klaus Rindtorff and Thomas Schaeck, "Pervasive Computing: Technology and Architecture of Mobile Internet Applications", Addison Wesley Publisher, 2002.

**REFERENCE:**

Sumi Helal, "The Landscape of Pervasive Computing Standards", Morgan and Claypool Publishers, 2010.

**15CSE363 PRINCIPLES OF DIGITAL IMAGE PROCESSING****3 0 0 3****Unit 1**

Mathematical Background for Image Processing: Review of Vectors and Matrices - Review of Probability and statistics. Digital Image Fundamentals: Elements of

Visual Perception - Image Sensing and Acquisition – Image Sampling and Quantization – Basic Relationships between Pixels - Image interpolation. Intensity Transformations and Spatial Filtering: Basic Intensity transformation Functions – Histogram Processing – Fundamentals of Spatial Filtering – Smoothing and Sharpening Spatial Filters.

**Unit 2**

Filtering in Frequency Domain: 2D Discrete Fourier Transforms - Basics of filtering - Image Smoothing and Image Sharpening Using Frequency Domain Filters - Selective Filtering, Image Restoration: Noise Models – Restoration using Spatial Filters – Periodic Noise Reduction by Frequency Domain Filters.

**Unit 3**

Morphological Image Processing: Erosion – Dilation – Opening – Closing – Hit-or-Miss Transform - Extraction of Connected Components. Image Segmentation: Fundamentals – Point, Line and Edge Detection – Thresholding - Region Based Segmentation – Region Growing – Region Splitting and Merging. Color image processing.

**TEXTBOOK:**

Gonzalez R C and Woods R E, "Digital Image Processing", Third Edition, Pearson Education, 2009.

**REFERENCES:**

1. Pratt W K, "Digital Image Processing", Fourth Edition, John Wiley & Sons, 2007.
2. Castleman K R, "Digital Image Processing", Prentice Hall, 1996.
3. Gonzalez, Woods and Eddins, "Digital Image Processing Using MATLAB", Prentice Hall, 2004.
4. Russ J C, "The Image Processing Handbook", CRC Press, 2007.

**15CSE364****REAL-TIME COMPUTING SYSTEMS****3 0 0 3****Unit 1**

Basic Real-Time Concepts: Terminology – Real-Time system design issues – Example Real-time systems Hardware Considerations: Basic architecture – Hardware interfacing - Central Processing Unit – Memory – Input / Output – Enhancing performance Real-Time Operating Systems: Real-Time kernels – Theoretical foundations of real-time operating systems – Intertask communication and synchronization – Memory management.

**Unit 2**

Software Requirements Engineering: Requirements engineering process – Types of requirements – Requirements specification for Real-time systems – Formal methods in software specification – Structured analysis and design – Object oriented analysis and the Unified Modelling Language (UML) Software System Design: Properties of software – Basic software engineering principles – The design activity – Procedural oriented design – Object oriented design.



**Unit 3**

Performance Analysis and Optimization: Theoretical Preliminaries – Performance Analysis – Application of Queuing theory – I/O performance – Performance Optimization – Results from compiler optimization – Analysis of memory requirements – Reducing memory utilization.

**TEXTBOOK:**

Laplante P A, "Real-Time Systems Design and Analysis", Third Edition, Wiley-India, 2005.

**REFERENCES:**

1. Williams R, "Real-Time Systems Development", Elsevier, 2006.
2. Liu J W S, "Real-Time Systems", Prentice Hall, 2000.

**15CSE365****SCIENTIFIC COMPUTING****3 0 0 3****Unit 1**

Systems of Linear Algebraic equations: Introduction, Gauss Elimination Method, LU decomposition, Symmetric and banded coefficient Matrices, Pivoting, Matrix Inversion, Iterative Methods, Other methods.

**Unit 2**

Interpolation and Curve Fitting: Polynomial Interpolation, Least square fit, Other methods; Roots of equations: Search Methods, Method of Bisection, Roots of Equations, Brent's method, Newton Raphson Method, Systems of Equations, Zeros of Polynomials

**Unit 3**

Numerical Differentiation: Finite Difference approximations; Numerical Integration; Initial Value Problems; Two-Point Boundary Value Problems; Symmetric Matrix Eigen value problems; Introduction to Optimization.

**TEXTBOOK:**

Jaan Kiusalaas, "Numerical Methods in Engineering with Python", Cambridge University Press, 2005.

**15CSE366****SEMANTIC WEB****3 0 0 3****Unit 1**

The semantic web vision - introduction to semantic web technologies - a layered approach, Describing web resources - RDF data model, RDF syntax, RDF Schema, Querying the semantic web - SPARQL infrastructure, matching patterns, Filters, organizing the results, querying the schema, adding information with SPARQL update.

**Unit 2**

Web ontology Language - introduction, requirement of ontology languages, the OWL language, Logics and Inferences - Monotonic rules and semantics, OWL2 RL, rules inference format, SWRL, SPIN, Rule ML.

**Unit 3**

Ontology Engineering - Constructing ontologies manually, Reusing existing ontologies, Semiautomatic ontology acquisition, ontology mapping, semantic web applications architecture, Applications - BBC artists, BBC world Cup 2010 website, government data, schema.org.

**TEXTBOOK:**

Paul Groth, Frank van Harmelen, Rinke Hoekstra, "A Semantic Web Primer", Third edition, MIT Press, 2012

**REFERENCES:**

1. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", CRC Press, 2009.
2. Karin Breitman, Marco Antonio Casanova, Walt Truszkowski, "Semantic Web: Concepts, Technologies and Applications", Springer Science & Business Media, 2007.

**15CSE367****SERVICE-ORIENTED ARCHITECTURE****3 0 0 3****Unit 1**

SOA Fundamentals - Defining SOA - Business Value of SOA – Architecture - Infrastructure Services Web Services Technologies: Web Services & SOA - WSDL, SOAP – UDDI – WS-Transaction, WS-Security - WS-Reliable Messaging. WS-Policy - WS-Attachments.

**Unit 2**

BPEL for Web Services SOA Planning and Analysis - Lifecycle - Capturing Business IT Issues - Determining Non-Functional Requirements - Enterprise Solution Assets - Tools Available for Appropriate Designing - Implementing SOA. SOA Platform Basics: SOA Support in J2EE, JAX-WS, JAXB, JAXR, JAX-RPC, WSIT, SOA support in .NET, ASP.NET web services.

**Unit 3**

Introduction to Cloud Computing - Cloud Computing (NIST Model) Properties - Service Models (XaaS), The Google File System - Virtualization Techniques in Cloud - Parallelization in Cloud - Privacy in Cloud - Data Processing in Large Clusters. Google's Map Reduce Programming Model.

**TEXTBOOK:**

1. Thomas Erl, "Service Oriented Architecture, Concepts, Technology and Design", Prentice Hall of India, 2005.

**REFERENCES:**

1. Norbert Bieberstein, Sanjay Bose, Marc Fiammente, Keith Jones and Rawn Shah, "Service Oriented Architecture Compass: Business Value, Planning and Enterprise Roadmap", Second Edition, IBM Press, 2005.
2. Sandy carter, "The New Language of Business: SOA and Web 2.0", IBM press, 2007.
3. Thomas Erl, "Service Oriented Architecture: A Field Guide to Integrating XML and Web Services", First Edition, Prentice Hall, 2004.
4. Toby Velte, Anthony Velte and Robert Elsen Peter, "Cloud Computing A Practical Approach", First Edition, Tata McGraw-Hill, 2009.

**15CSE368****SOFTWARE QUALITY ASSURANCE****3 0 0 3****Unit 1**

Introduction - Software Quality in the Business Context - Managing Software Quality in the Organization - Quality Management Systems - Planning for Software Quality Assurance - Product Quality and Process Quality.

**Unit 2**

Software Measurement and Metrics - Walkthroughs and Inspections - ISO 9001 - What is ISO 9001 - What CMMI - Introduction to CMMI is for development - Process Area Components - Understanding Capability Levels - Introduction to People CMM.

**Unit 3**

Statistical Quality Control and Process Control - Software Maintenance Models - Cyclomatic Complexity - Principles of Coupling and Cohesion - Introduction to Six Sigma, Case Studies - Indian Software Industry in perspective.

**TEXTBOOK:**

Godbole N, "Software Quality Assurance, Principles and Practice", Narosa Publications, 2011.

**REFERENCES:**

1. CMMI Product Team. CMMI for Development, Version 1.3(CMU/SEI-2010-TR-033). Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University, November 2010. <http://www.sei.cmu.edu/library/abstracts/reports/10tr033.cfm>.
2. Bill Curtis, William Hefley and Sally A. Miller, "The People CMM: A Framework for Human Capital Management", Second Edition, Addison-Wesley, 2009.
3. Perry W, "Effective Methods of Software Testing", Third Edition, Wiley Publication, 2007.
4. Pankaj Jalote, "An Integrated Approach to Software Engineering", Third Edition, Springer, 2006.
5. Bill Curtis, William E. H, Sally A. M, "People CMM: A Framework for Human Capital Management", Second Edition, Pearson Education, 2009.

**15CSE369****SPATIOTEMPORAL DATA MANAGEMENT****3 0 0 3****Unit 1**

Introduction to Spatial Databases: Requirements, Principles, and Concepts for Spatial Database Management Systems (SDBMS) - Spatial Databases and Geographic Information Systems SDBMS and GIS Applications.

**Unit 2**

Models for Spatial Data: Geographic Space Modelling - Representation Models - Geometry of Collection of Objects - Vector Data - Raster Data - Modelling Spatial Data. Spatial Access Methods (SAM): Issues in SAM Design - Space Driven Structures versus Data Driven Structures - The Grid File - Quadtree and Variants - R-Tree and Variants - k-d-B Tree - Other common and useful SAM - Cost Models.

**Unit 3**

Query Processing: Algebras and Query Languages for Spatial Data - Spatial Join Queries - Nearest Neighbour Queries - Queries over Raster Data (Map Algebra) - Cost Models. Spatio-Temporal Databases: Introduction to Temporal Databases - Specialized Index Structures - Query Processing. Spatial DBMS and GIS - GRASS - Post GIS, Advanced Topics: Geographic Data Mining - Streaming (remotely-sensed) Data - Mobile Objects and Location Aware Services.

**TEXTBOOK:**

Philippe Rigaux, Michel Scholl, Agnes Voisard, "Spatial Databases with Applications to GIS", Morgan Kaufman, 2002.

**REFERENCES:**

1. Shashi Shekhar, Sanjay Chawla, "Spatial Databases: A Tour", Prentice Hall, 2003.
2. H. Samet, "Foundations of Multidimensional and Metric Data Structures", Morgan-Kaufmann, 2006.

**15CSE370****WIRELESS AND MOBILE COMMUNICATION****3 0 0 3****Unit 1**

Introduction to wireless communications: Evolution of mobile radio communications, paging system, cordless telephone system, cellular telephone system, Modern wireless communication systems: 2G networks, 3G networks, Bluetooth and personal area networks.

**Unit 2**

Mobile radio propagation: large scale path loss - Free space propagation model, basic propagation mechanisms. Digital Cellular Transmission, Spread Spectrum Transmissions Local Area & Ad Hoc Networks: LAN Technologies: Evolution of

Wireless LAN, IEEE802.11, Physical, Layer, MAC Sub-layer, routing algorithms. Adhoc networks: Characteristics – Performance issues. Overview to Wireless ATM, HYPERLAN, IEEE802.15 Wireless PAN, and Home RF.

### Unit 3

Bluetooth Cellular concepts: Frequency reuse, channel assignment strategies, hand off strategies, interference and system capacity, improving coverage and capacity in cellular systems, routing in mobile hosts. Mobile IP – DHCP - Mobile transport layer – Indirect TCP - Snooping TCP - Transmission / time-out freezing – Selective retransmission –Transaction oriented TCP.

#### TEXTBOOK:

Rappaport T S, "Wireless Communication: Principles and Practice", Second Edition, Pearson Education, 2009.

#### REFERENCES:

1. Pahlavan K and Krishnamurthy P, "Principles of Wireless Networks", Prentice-Hall, 2006.
2. Stallings W, "Wireless communications and networks", Pearson Education Limited, 2002.
3. Jochen S, "Mobile communications", Pearson Education Limited, 2000.
4. Lee W C Y, "Wireless and Cellular Communications", Third Edition, Tata McGraw Hill Publishing Company Limited, 2006.

**15CSE371**

**WIRELESS AND MOBILE COMPUTING**

**3 0 0 3**

### Unit 1

Wireless Networks – basic routing protocols -- power saving techniques - Disruption tolerant networks – routing - Mobility Service Architecture, Mobility Environment Architecture, Mobile Computing Devices and Features, Design Issues, data types - Challenges in Mobile Computing Adaptive Application in Mobile Environment: Adaptability and Adaption, Adaptability Issues, Mobility Management, Handoff, Location Management Principles and Techniques, Registration Area-Based Location Management, Forwarding Pointers, PCS Location Management Scheme, Energy Efficient Network Protocols, Routing Protocols, Mobile IP, Energy Efficient Indexing.

### Unit 2

Data Dissemination and Management: Issues Facing Data Dissemination in a Mobile Environment, Bandwidth Allocation for Publishing, Broadcast Disk Scheduling, Push-based Data Scheduling, On-demand Data Scheduling, Hybrid Data Scheduling, Caching Management in Mobile, Characteristics of Mobile Cache, Cache Management Schemes, Mobile Web Caching, social aware data forwarding – data dissemination, urban sensing.

Mobile Middleware – Challenges - Categories - Characteristics, Traditional Middleware Applied in Mobile Computing, Mobile Agents, Mobile Agent Architecture, Mobile Agent Security and Fault Tolerance using Distributed Transactions, Reliable Agent Transfer, Architecture of a Secure Agent System, Network Security Testing using Mobile Agents.

### Unit 3

Programming Mobile Devices: Motivation and Programming Strategies - Memory Management - Energy and resource management - Power-aware Computing: Power management – Operating System level Power management – Power-aware real-time system. Design Patterns for Limited Memory, Memory Management in Mobile Java, Memory Management in Android OS Applications - Workflow for Application Development, Techniques for Composing Applications, Application Models in Mobile Java, Case study: Android OS Application Infrastructure – Advanced Telecommunications Computing Architecture. Cluster computing - Grid computing - Virtualisation and Cloud Computing - mobile cloud – Activity recognition – crowd sourcing – security and privacy issues.

#### TEXTBOOK:

Stojmenovic and Cacate, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.

#### REFERENCES:

1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning 2012.
2. Uhler, David, Mehta, Khanjan, "Mobile Computing, Applications, and Services", Fourth International Conference, MobiCASE 2012, Springer, Seattle, WA, USA, October 2012.
3. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional, 2005.

**15CSE372**

**WIRELESS SENSOR NETWORKS**

**3 0 0 3**

### Unit 1

Overview of WSN: Introduction, Sensor network applications – Habitat Monitoring –Tracking chemical plumes - Smart transportation. Constraints and Challenges, Emerging technologies for wireless sensor networks - Advantages of sensor networks.

### Unit 2

Architectures: Hardware components – sensor node overview – controller- memory – communication device - sensors and actuators – power supply of sensor nodes – Network architecture – Sensor network scenarios – types of sources and sinks – single hop Vs multi hop - multiple sources and sinks – mobility - Gateway Concepts.

**Unit 3**

Protocols: MAC Protocols for Wireless Sensor Networks - Low duty cycle protocol: SMAC - Contention Based Protocol: CSMA, Scheduling Based Protocol – Routing Protocol: AODV, DSDV, optimized Linked State Routing, DSR and Reactive routing: Flooding, Hierarchical routing, Location based Routing - Unicast and Multicast.

**TEXTBOOK:**

Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.

**REFERENCES:**

1. Feng Zhao and Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
2. Kazem Sohraby, Daniel Minoli, and Taieb Znati, "Wireless Sensor Networks -Technology, Protocols and Applications", John Wiley, 2007.
3. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

**15CSE373****NET CENTRIC PROGRAMMING****2 0 2 3****Unit 1**

Introduction to Internet: The domain name system – Client / Server model – Internet Services of the Internet – Ports – IP addresses – Web architecture – Parsing in Browsers – Web site design standards. Client Side Technologies: Introduction to Markup languages (SGML, HTML, DHTML) – Introduction to scripting languages (Javascript, VBScript, PHP). XML: Comparison with HTML - DTD - XML Elements - Content Creation - Attributes - Entities - XSL - XLINK - XPATH - XPOINTER - Namespaces - Applications - Integrating XML with other applications.

**Unit 2**

J2EE: Architecture - Servlets, Java Server Pages – Java Beans – Building EJB applications.

**Unit 3**

Middleware Architecture: CORBA, MULE, ACTIVE MQ.

**TEXTBOOKS:**

1. Bates C, "Web Programming - Building Internet Application", Second Edition, Wiley-Dreamtech India Pvt. Ltd., 2002.
2. Pitter K, Amato S and Callahan J et al, "Every students guide to the Internet", Tata McGraw Hill, 2005.
3. Aaron W E, "J2EE a Professional Guide", Tata McGraw Hill, 2003.

**15CSE381****COMPUTER ORGANIZATION AND ARCHITECTURE LAB.****0 0 2 1**

Familiarization with a MIPS Simulator SPIM (PCSPIM – a PC version of SPIM will be used) - MIPS assembly program that inputs two integers from the user and displays their sum - MIPS assembly program that asks user to enter an integer n and displays nth Fibonacci number - Test your programs using SPIM simulator - MIPS assembly program that asks user to enter an integer n and displays its factorial. Implementation of pipeline concepts and exploring its operations - Implementation of vector operations in MIPS Assembly and exploring Loop Unrolling. Design of single instruction CPU Design of a simple Memory Unit CPU using simulator. Design of ALU with at-least 8 operations. Design of simple memory with m number of address lines and n number of data lines. Design of Associative / Direct Mapped Cache memory design.

**15CSE385****COMPILER DESIGN LAB.****0 0 2 1**

Tokenizing using DFA - Design of Lexical Analyzer (Tools: Jlex / JFlex / Lex) – Design of Parser (Tools: YACC / CUP / Bison / ANTLR): Recursive Descent Parser, LL/LR Parser - Creation of Abstract Syntax Tree (Tools: YACC / CUP / Bison / ANTLR) - Creation of Symbol tables - Semantic Analysis - Generation of Intermediate Code.

**15CSE386****COMPUTER NETWORKS LAB.****0 0 2 1**

Client server communication using basic socket communication (TCP and UDP- one way and Two way communication). Experimental study of Application Protocols using HTTP, FTP, SMTP, using Network packet sniffers and analyzers such as Ethereal – Exercises in Socket Programming in C / C++ / Java. Implementation of unicast, broadcast and multicast Communication. Packet Sniffers for understanding the TCP Protocol – File Transfer between nodes in a Network – CSMA / CD - Introduction to ns2 (Network Simulator) – Small Simulation exercises to study TCP Behaviour under different scenarios. Setting up a small IP network - Configure interfaces, IP addresses and routing Protocols to set up a small IP network. Study dynamic behavior using packet sniffers – Design and Implementation of congestion control in TCP/IP Network.

**15CSE387****OPEN LAB.****0 1 2 2**

Open Labs are introduced to help with more programming. In addition students can learn specific state of art technologies that can help them prepare for the industry and higher studies. Tools like Open CV, Python, Open GL may be explored.

**15CSE390 / 15CSE490****LIVE-IN-LAB.****3 cr**

This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after fourth semester or sixth semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth or seventh semester. The objectives and projected outcome of the project should be reviewed and approved by the Dept. chairperson and a faculty assigned as the project guide. On completion of the project, the student shall submit a detailed project report. The report shall be evaluated and the students shall appear for a viva-voce test on the project.

**15CSE401 MACHINE LEARNING AND DATA MINING****3 0 0 3****Unit 1**

Introduction to Machine learning: Supervised learning, Unsupervised learning, some basic concepts in machine learning, Review of probability, Computational Learning theory. Bayesian concept learning, Likelihood, Posterior predictive distribution, Naive Bayes classifiers, The log-sum-exp trick, Feature selection using mutual information, Linear Regression, Logistic regression.

**Unit 2**

Introduction to data mining - challenges and tasks, measures of similarity and dissimilarity, Classification - Rule based classifier, Nearest - neighbour classifiers -Bayesian classifiers - decision trees; support vector machines, Class imbalance problem performance evaluation of the classifier, comparison of different classifiers.

**Unit 3**

Association analysis – frequent item generation rule generation, evaluation of association patterns. Cluster analysis, K means algorithm, cluster evaluation, application of data mining to web mining and Bioinformatics. Classifying documents using bag of words advertising on the Web, Recommendation Systems, and Mining Social network graphs.

**TEXTBOOKS:**

1. Kevin P. Murphy, "Machine Learning, a probabilistic perspective", The MIT Press, 2012.
2. Jiawei Han and MichelineKamber, Jian Pei, "Data Mining: Concepts and Techniques", Third Edition, Elsevier, 2012.

**REFERENCES:**

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", First Edition, Pearson Education, 2006.
2. Tom Mitchael, "Machine Learning", McGraw Hill, 1997.

**15CSE402****STRUCTURE AND INTERPRETATION OF COMPUTER PROGRAMS****3 1 0 4****Unit 1**

Introduction to LISP and Scheme – Building abstractions with procedures: Elements of programming procedures and processes they generate – Formulating abstracts with higher-order procedures.

**Unit 2**

Building abstractions with data: Introduction to data abstraction – Hierarchical data and the closure property – Symbolic data – Multiple representations for abstract data – Systems with generic operations.

**Unit 3**

Modularity, object and state: Assignment and local state – Environment model of evaluation – Modeling with mutable data – Concurrency – Streams

**TEXTBOOK:**

Abelson H and Sussman G. J., "Structure and Interpretation of Computer Programs", Second Edition, MITPress, 2005.

**REFERENCES:**

1. Brian Harvey and Matthew Wright, "Simple Scheme: Introducing Computer Science", Second Edition, MIT Press, 1999.
2. M. Felleisen, R. B. Flinger, M. Flatt and S. Krishnamurthy, "How to Design Programs: An Introduction to Programming and Computing", MIT Press, 2001.
3. Daniel P. Friedman and M. Felleisen, "The Little Schemer", Fourth Edition, MIT Press, 1995.
4. Daniel P. Friedman and M. Felleisen, "The Seasoned Schemer", MIT Press, 1995.

**15CSE411****SOFTWARE PROJECT MANAGEMENT****3 0 0 3****Unit 1**

Introduction to Software Project Management - Software Projects - ways of categorizing software projects – problems with software projects - Project Life Cycle – Management - Setting objectives – Stakeholders - Project Team – Step Wise: An overview of project planning - Project evaluation - Selection of appropriate project approach. Software effort estimation – function point analysis - objects point – COCOMO.

**Unit 2**

Activity planning - project schedules - sequencing and scheduling projects - Network planning models - AON and AOA - identifying critical activities - crashing and fast tracking, Risk management: Categories, Risk planning, management and control -

Evaluating risks to the schedule, PERT. Resource allocation - identifying resource requirements - scheduling resources - creating critical paths - publishing schedule - cost schedules - sequence schedule.

**Unit 3**

Monitoring and control – Visualizing progress, Earned value analysis – Managing people and organizing teams – organizational structures - Planning for small projects. Case Study: PMBOK. Agile Development.

**TEXTBOOK:**

Hughes B, Cotterell M and Rajib M, "Software Project Management", Fifth Edition, Tata McGraw-Hill, 2012.

**REFERENCES:**

1. Pressman R S, "Software Engineering – A Practitioner's Approach", Eighth Edition, McGraw-Hill Publishers, 2014.
2. Jalote P, "Software Project Management in Practice", Second Edition, Pearson Education, 2003.

**15CSE430 PROJECT BASED ELECTIVE 2 0 2 3**

Project based electives introduced to help students merge the theoretical and practical aspects of computer science and learn the subject through live projects. They enable the students to get hands-on experience in the latest trends in computer science. The expected outcome is a minor project on a problem identified.

**15CSE481 MACHINE LEARNING AND DATA MINING LAB. 0 0 2 1**

This should be a Case Study involving classification including document classification or clustering including graph clustering with applications like recommendation systems, advertising on the web, using ML tools.

**15CSE495 PROJECT PHASE I 2 cr**

More credits for practical application of Computer Science and help students innovate. Support for publications, patenting and entrepreneurship through such efforts.

Identifying the domain, literature survey, problem definition, design, and partial implementation.

**15CSE499 PROJECT PHASE II 10 cr**

More credits for practical application of Computer Science and help students innovate. Support for publications, patenting and entrepreneurship through such efforts.

Implementation of the project, testing, paper preparation, and documentation.

**15CUL101 CULTURAL EDUCATION I 2 0 0 2****Unit 1**

Introduction to Indian Culture; Introduction to Amma's Life and Teachings; Symbols of Indian Culture.

**Unit 2**

Science and Technology in ancient India; Education in Ancient India; Goals of Life - Purusharthas; Introduction to Vendanta and Bhagavat Gita.

**Unit 3**

Introduction to Yoga; Nature and Indian Culture; Values from Indian History; Life and work of Great Seers of India.

**TEXTBOOKS:**

1. *The Glory of India (in-house publication)*
2. *The Mother of Sweet Bliss (Amma's Life & Teachings)*

**15CUL111 CULTURAL EDUCATION II 2 0 0 2****Unit 1**

1. Relevance of Sri Rama and Sri Krishna in this Scientific Age
2. Lessons from the Epics of India
3. Ramayana & Mahabharata

**Unit 2**

4. Who is a Wise Man?
5. A Ruler's Dharma
6. The Story of King Shibi

**Unit 3**

7. Introduction to the Bhagavad Gita
8. Bhagavad Gita – Action without Desire

**Unit 4**

9. Role and Position of Women in India
10. The Awakening of Universal Motherhood

**Unit 5**

11. Patanjali's Astanga-Yoga System for Personality Refinement
12. Examples of Heroism and Patriotism in Modern India

**TEXTBOOKS:**

*Common Resource Material II (in-house publication)*

*Sanatana Dharma- The Eternal Truth (A compilation of Amma's teachings on Indian Culture)*

### 15CUL230                      **ACHIEVING EXCELLENCE IN LIFE -                      2 0 0 2** **AN INDIAN PERSPECTIVE**

**OBJECTIVES:** *The course offers to explore the seminal thoughts that influenced the Indian Mind on the study of human possibilities for manifesting excellence in life. This course presents to the students, an opportunity to study the Indian perspective of Personality Enrichment through pragmatic approach of self analysis and application.*

**Unit 1**

Goals of Life – Purusharthas

What are Purusharthas (Dharma, Artha, Kama, Moksha); Their relevance to Personal life; Family life; Social life & Professional life; Followed by a Goal setting workshop;

Yogic way of Achieving Life Goals – (Stress Free & Focused Life)

Introduction to Yoga and main schools of Yoga; Yogic style of Life & Time Management (Work Shop);

Experiencing life through its Various Stages

Ashrama Dharma; Attitude towards life through its various stages (Teachings of Amma);

**Unit 2**

Personality Development

What is Personality – Five Dimensions – Pancha Kosas (Physical / Energy / Mental / Intellectual / Bliss); Stress Management & Personality; Self Control & personality; Fundamental Indian Values & Personality;

Learning Skills (Teachings of Amma)

Art of Relaxed Learning; Art of Listening; Developing 'Shraddha' – a basic qualification for obtaining Knowledge;

Communication Skills - An Indian Perspective;

**Unit 3**

Developing Positive Attitude & Friendliness - (Vedic Perspective);

Achieving Work Excellence (Karma Yoga by Swami Vivekananda & teachings based on Amma);

Leadership Qualities – (A few Indian Role models & Indian Philosophy of Leadership);

**REFERENCE BOOKS:**

1. *Awaken Children (Dialogues with Sri Mata Amritanandamayi) Volumes 1 to 9*
2. *Complete works of Swami Vivekananda (Volumes 1 to 9)*
3. *Mahabharata by M. N Dutt published by Parimal publications – New Delhi (Volumes 1 to 9)*
4. *Universal message of Bhagavad-Gita (An exposition of Gita in the light of modern thought and Modern needs) by Swami Ranganathananda. (Vols.1 to 3)*
5. *Message of Upanishads, by Swami Ranaganathananda published by Bharatiya Vidya Bhavan, Bombay.*
6. *Personality Development – Swami Vivekananda published by Advaita Ashram, Kolkatta.*
7. *Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay*
8. *Will Power and its Development- Swami Budhananda published by Advaita Ashram, Kolkatta*
9. *Ultimate Success - Swami Ramakrishnananda Puri published by Mata Amritanandamayi Math, Kollam*
10. *Yoga In Daily Life - Swami Sivananda – published by Divine Life Society*
11. *Hindu Dharma - H. H. Sri Chandrasekharandra Saraswati published by Bharatiya Vidya Bhavan, Bombay*
12. *All about Hinduism – Swami Sivananda - Published by Divine Life Society*
13. *The Mind and its Control by Swami Budhananda published by Advaita Ashram, Kolkatta*
14. *Krida Yoga - Vivekananda Kendra, Publication.*
15. *Valmiki Ramayana – Four volumes- published by Parimal Publications, Delhi*
16. *New perspectives in Stress Management - Dr H R Nagendra & Dr R Nagaratna published by Swami Vivekananda Yoga Prakashana, Bangalore.*
17. *Mind Sound Resonance Technique (MSRT) Published by Swami Vivekananda Yoga Prakashana, Bangalore.*
18. *Yoga & Memory - Dr H R Nagendra & Dr. Shirley Telles, published by Swami Vivekananda Yoga Prakashana, Bangalore.*

### 15CUL231                      **EXCELLENCE IN DAILY LIFE                      2 0 0 2**

**Unit 1**

- 1 The anatomy of 'Excellence'. What is 'excellence'? Is it judged by external factors like wealth?
- 2 The Great Flaw. The subject-object relationship between individual and world. Promote subject enhance excellence.
- 3 To work towards excellence, one must know where he is. Our present state... An introspective analysis. Our faculties within.

**Unit 2**

- 4 The play of the mind. Emotions – convert weakness into strength.
- 5 The indispensable role of the intellect. How to achieve and apply clear thinking?

- 6 The quagmire of thought. The doctrine of Karma – Law of Deservance.  
7 Increase Productivity, reduce stress.. work patterning.

**Unit 3**

- 8 The art of right contact with the world. assessment, expectations.  
9 Myths and Realities on key issues like richness, wisdom, spirituality.  
10 Collect yourself, there is no time to waste. The blue-print of perfect action.

**REFERENCES:**

*The Bhaja Govindam and the Bhagavad Gita.*

**15CUL232 EXPLORING SCIENCE AND TECHNOLOGY 2 0 0 2  
IN ANCIENT INDIA**

**OBJECTIVES:** *This course offers a journey of exploration through the early developments in India of astronomy, mathematics, technologies and perspectives of the physical world. With the help of many case studies, the students will be equipped to understand concepts as well as well as actual techniques.*

**Unit 1**

1. General introduction: principles followed and sources;
2. Astronomy & mathematics from the Neolithic to the Indus civilization;
3. Astronomy & mathematics in Vedic literature;
4. Vedanga Jyotisha and the first Indian calendars;
5. Shulba Sutras and the foundations of Indian geometry;

**Unit 2**

6. Astronomy & mathematics in Jain and Buddhist literature;
7. The transition to the Siddhantic period; Aryabhata and his time;
8. The Aryabhatiya: concepts, content, commentaries;
9. Brahmagupta and his advances;
10. Other great Siddhantic savants;
11. Bhaskara II and his advances;

**Unit 3**

12. The Kerala school of mathematics;
13. The Kerala school of astronomy;
14. Did Indian science die out?;
15. Overview of recent Indian scientists, from S. Ramanujan onward;
16. Conclusion: assessment and discussion;

**TEXTBOOK:**

*Indian Mathematics and Astronomy: Some Landmarks, by S. Balachandra Rao*

**REFERENCE:**

*IFIH's interactive multimedia DVD on Science & Technology in Ancient India.*

**15CUL233 YOGA PSYCHOLOGY 2 0 0 2**

**OBJECTIVES:** *This course offers the foundation necessary to understand Eastern approaches to psychology and spirituality. The course includes experiential components centering on meditation and spiritual practice.*

**Unit 1**

Introduction

Introduction to Modern Psychology

A short history of Modern Psychology - Major Schools of Modern Psychology - The three major forces in Western Psychology - Freudian Psychoanalysis; Behaviourism; Humanistic Psychology.

Introduction to Indian Psychology

What is Yoga? - Rise of Yoga Psychology tradition - Various schools of Yoga Psychology - Universal Goal of all Yoga-schools.

Patanjali Yoga Sutra – 1

Introduction to Rishi Patanjali - Bird view of Yoga-Sutra - Definition of Yoga – Vrittis.

Patanjali Yoga Sutra – 2

Five Kinds of Vrittis - Pramanam - sources of right knowledge - Viparyayah – unfolded belief - Vikalpah – Unfolded belief - Smriti – Memory.

**Unit 2**

Patanjali Yoga Sutra – 3

Two formulae - Necessity of Abhyasah and Vairagyah - Foundation of Abhyasah - Foundation of Vairagyah.

Patanjali Yoga Sutra – 4

Introduction to Samadhi - Samprajnata-Samadhi - Reasoning in Samprajnata-Samadhi - Reflection in Samprajnata-Samadhi - Bliss in Samprajnata-Samadhi - Sense of Individuality in Samprajnata-Samadhi.

Patanjali Yoga Sutra – 5

Main obstacles in the path of Yoga - other obstructions - removal of obstacles by one – pointedness; by controlling Prana - by observing sense experience - by



inner illumination - by detachment from matter - by knowledge of dream and sleep - by meditation as desired.

Patanjali Yoga Sutra – 6

How to make mind peaceful? - Cultivating opposite virtues: happiness – friendliness - misery – compassion - virtue – gladness - vice – indifference.

Patanjali Yoga Sutra – 7

Five causes of Pain - avidya – ignorance (Root Cause) - asmita – ‘I-Feeling’ - raga – attraction - dwesha – repulsion - abhinivesha – clinging to life.

### Unit 3

Patanjali Yoga Sutra – 8

Necessity of Yoga practice - eight parts of Yoga practice - five Yamas: ahimsa – satya – asteya – brahmacharyam – aparigraha.

Patanjali Yoga Sutra – 9

Five Niyamas: Soucha – Santhosha – Tapas – Swadyah – Ishwara - Pranidhanam.

Patanjali Yoga Sutra – 10

Asanam – Pranayamah - various kinds of Pranayamah - Pratyaharah - Mastery over the senses.

Report review

Conclusion

### REFERENCES:

- The course book will be “The four chapters of Freedom” written by Swami Satyananda Saraswati of Bihar School of Yoga, Munger, India.
- “The message of Upanishads” written by Swami Ranganathananda. Published by Bharathiya Vidya Bhavan.
- Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda, Published by Advaita Ashram, Uttaranjal.
- ‘Hatha Yoga Pradipika’ Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India

**15ECE202 DIGITAL CIRCUITS AND SYSTEMS 3 1 0 4**

### Unit 1

Introduction to logic families: ECL – TTL - Tri state logic. Implementation technology: Transistor switches - NMOS logic gates - CMOS logic gates - Negative logic systems. Introduction to logic circuits: Variables and functions, inversion- Truth tables- Logic gates and Networks - Boolean algebra - Synthesis using gates -

Design examples - Optimized implementation of logic functions: Karnaugh map - Strategy for minimization - Minimization of product of sums forms - Incompletely specified functions - Multiple output circuits - Tabular method for minimization - Number representation and arithmetic circuits: Addition of unsigned numbers - Signed numbers - Fast adders.

### Unit 2

Combinational circuit building blocks: Multiplexers - Decoders - Encoders - Code converters - Arithmetic comparison circuits. Sequential circuit building blocks: Basic latch - Gated SR latch - Gated D latch - Master slave and edge triggered - D flip-flops - T flip-flop - JK flip-flop - Registers - Counters - Reset synchronization - Other types of counters.

### Unit 3

Synchronous sequential circuits: Basic design steps - State assignment problem - Mealy state model - Serial adders - State minimization. Asynchronous sequential circuits: Analysis of asynchronous circuits.

### TEXTBOOK:

Stephen Brown, Zvonko Vranesic, “Fundamentals of Digital logic with Verilog Design”, Tata McGraw Hill Publishing Company Limited, Special Indian Edition, 2007.

### REFERENCES:

1. Morris Mano, Michael D. Ciletti “Digital Design – with introduction to Verilog HDL”, Pearson Education, Fifth Edition, 2011.
2. Charles H., Jr. Roth, Lizy Kurian John, Beyond Kill Lee, “Digital System Design Using Verilog”, Cengage Learning, 2015.
3. Donald D Givone, “Digital Principles and Design”, Tata McGraw Hill Publishing Company Limited, 2003.

**15ECE281 DIGITAL CIRCUITS AND SYSTEMS LAB. 0 0 2 1**

1. Familiarization of Digital trainer kit and study of logic gates.
2. Realization of Boolean expressions using logic gates
3. Realization of Boolean expressions using universal gates
4. Realization of code converters
5. Design of Adders / Subtractors
6. Design of Multiplexers/ De-Multiplexers
7. Design of Encoders/ Decoders
8. Study of flip-flops
9. Design of Synchronous counters
10. Design of Asynchronous counters

**15EEE111 FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING 4 0 0 4**

**Unit 1**

Introduction to Electrical Power System; Ideal Independent Current and Voltage Sources, Reference Directions and Symbols; Resistance, Inductance and Capacitance; Ohm's law, Kirchhoff's law, Energy and Power - Series parallel combination of R, L and C Components, DC Series-Parallel Circuits - Voltage Divider and Current Divider Rules - Superposition Theorem, Network Analysis - Mesh and Node methods - Generation of sinusoidal voltage; Instantaneous, Average and effective values of periodic functions; Phasor representation.

**Unit 2**

Reactance and Impedance; Response in RLC circuits to sinusoidal voltage; Real and Reactive Power, Power factor; Complex Power and Power Triangle - Introduction to Three Phase Systems; Balanced 3-Phase STAR and DELTA connections of Load, Three phase power - Measuring Instruments for AC and DC quantities; Instruments to measure Voltage, Current, Power and Energy - Electromagnetic Induction; Magnetic Circuit Elements; Self and Mutual Inductances - Classification and Applications of Electrical Machines; Torque, Output Power and Efficiency. 3-Phase Induction Motor - Principle of operation, Slip, Torque-speed relation; Single Phase and Three Phase Transformers - Principle of Operation, turns ratio and Connections.

**Unit 3**

PN junction diode characteristics: unbiased diodes, forward and reverse bias – breakdown – barrier potential – diode approximation - Rectifiers: half wave and full wave - Zener diode – design of regulators and Characteristics - Introduction to BJT: characteristics curves and region of operation; Biasing: Load line – fixed and voltage divider bias - JFET characteristics – 555 Timer – transconductance - Introduction to Operational amplifier: inverting and non-inverting amplifier.

**TEXTBOOK:**

1. Edward Hughes, 'Electrical Technology' Seventh edition, Pearson Education Asia, 2011
2. A. P. Malvino, Electronic Principles, 7th Edition, Tata McGraw Hill, 2007

**REFERENCES:**

1. S K Bhattacharya, " Basic Electrical and Electronics Engineering", Pearson, 2012
2. Vincent Del Toro, 'Electrical Engineering Fundamentals', Second Edition, Prentice Hall of India Private Limited, 2003
3. David A Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press 2008
4. Michael Tooley B A, "Electronic Circuits: Fundamentals and Applications", Third Edition, Elsevier Ltd, 2006

**15EEE180 WORKSHOP B 0 0 2 1**

Part A - Electronics

Identification of electronic components (Passive and Active)  
 Study of measuring instruments (Voltmeter, Ammeter and Multimeter)  
 Measurement and theoretical Verification of series and parallel combination of resistors and capacitors  
 Calibration of CRO and measurements of signal parameters (RMS, maximum value, peak value, time and frequency)  
 Calibration of function generator using CRO  
 Soldering practice

Part B - Electrical

1. Study on power supply and protective devices
2. Study on tools and electrical accessories
3. Study on sources of light
4. Study on energy efficiency
5. Study on water pump
6. Study on house hold appliances:
  - a. Iron box
  - b. Fan
  - c. Refrigerator
  - d. Air conditioner
7. House wiring I – Glow an incandescent lamp using SPST switch
8. House wiring II – Glow a fluorescent lamp using SPST switch
9. House wiring III – Operate a fan and an incandescent lamp using two independent SPST switch
10. House wiring IV – Operate a fluorescent lamp and a 3 pin socket using two independent SPST switch
11. House wiring V – Staircase wiring
12. House wiring VI – Godown wiring

**15ENG111 COMMUNICATIVE ENGLISH 2 0 2 3**

**OBJECTIVES:** To make the students communicate their thoughts, opinions, and ideas freely and naturally; to make them understand the different styles in communication; to make the students understand the aesthetics of reading and writing; to bring in a spirit of enquiry; to motivate critical thinking and analysis; to help them ruminate on human values.

**Unit 1**

Reading: Different styles of communication – Reading Comprehension - critical thinking and analysis – Note-making – Any two pieces from the text.

**Unit 2**

Writing: Prewriting techniques - Kinds of paragraphs - basics of continuous writing.

Grammar & Usage: Parts of Speech, Tenses, Concord, Phrasal Verbs, Modal Auxiliaries, Modifiers (Workbook) - Any two pieces from the text.

**Unit 3**

Practical sessions (Listening & Speaking): Introduction to English pronunciation including minimal pairs and word stress – differences between British and American English – Listening comprehension and Note-taking - Any two pieces from the text.

Activities: Short speeches, seminars, quizzes, language games, debates, and discussions, Book Reviews, etc.

*Text: Language through Reading: Compilation by Amrita University for internal circulation*

Poems:

- i. The Poplar Field by William Cowper
- ii. Telephone Conversation by Wole Soyinka

Prose:

- i. Higher Mathematics by R. K. Narayan
- ii. Wings of Fire by Abdul Kalam (Part III.11)

Short Stories:

- i. Best Investment I Ever Made by A. J. Cronin
- ii. Death of an Indian by Krishna Charan Das

*1. Language through Practice: Compilation by Amrita University for internal circulation*

**15ENG230 BUSINESS COMMUNICATION 1 0 2 2**

**OBJECTIVES:** To introduce business vocabulary; to introduce business style in writing and speaking; to expose students to the cross-cultural aspects in a globalised world; to introduce the students to the art of persuasion and negotiation in business contexts.

**Unit 1**

Business Vocabulary - Writing: Drafting Notices, Agenda, and Minutes - Reading: Business news, Business articles.

**Unit 2**

Writing: Style and vocabulary - Business Memorandum, letters, Press Releases, reports – proposals – Speaking: Conversational practice, telephonic conversations, addressing a gathering, conducting meetings.

**Unit 3**

Active Listening: Pronunciation – information gathering and reporting - Speaking: Cross-Cultural Issues, Group Dynamics, negotiation & persuasion techniques.

Activities

Case studies & role-plays.

**BOOKS RECOMMENDED:**

1. Jones, Leo & Richard Alexander. *New International Business English*. CUP. 2003.
2. Horner, David & Peter Strutt. *Words at Work*. CUP. 1996.
3. Levi, Daniel. *Group Dynamics for Teams*. 3 ed. Sage Publications India Pvt. Ltd. New Delhi, 2011.
4. Owen, Roger. *BBC Business English*. BBC. 1996.
5. Henderson, Greta LaFollette & Price R Voiles. *Business English Essentials*. 7th Edition. Glencoe / McGraw Hill.
6. Sweeney, Simon. *Communicating in Business*. CUP. 2000.

**15ENG231 INDIAN THOUGHT THROUGH ENGLISH 1 0 2 2**

**OBJECTIVES:** To expose the students to the greatness of Indian Thought in English; to develop a sense of appreciation for the lofty Indian Thought; to develop an understanding of the eclectic Indian psyche; to develop an understanding about the societal changes in the recent past.

**Unit 1 Poems**

Rabindranath Tagore's Gitanjali (1-10); Nizzim Ezekiel's Enterprise; A.K. Ramanujam's Small-Scale Reflections on a Great House.

**Unit 2 Prose**

Khushwant Singh's The Portrait of a Lady; Jhumpa Lahiri's Short Story - Interpreter of Maladies.

**Unit 3 Drama and Speech**

Vijay Tendulkar's Silence, the Court is in Session; Motivational speeches by Jawaharlal Nehru/ S. Radhakrishnan / A. P. J. Abdul Kalam's My Vision for India etc. (any speech).

**REFERENCES:**

1. Lahiri, Jhumpa. *Interpreter of Maladies*, Harper Collins Publications, 2000.
2. Ramanujan A. K. ed. K. M. George, *Modern Indian Literature: An Anthology, Vol. I, Sahitya Akademi*, 1992.
3. Singh, Khushwant. *The Portrait of a Lady: Collected Stories*, Penguin, 2009.
4. Tagore, Rabindranath. *Gitanjali*, Penguin Books India Pvt. Ltd, 2011.
5. Tendulkar, Vijay. *Five Plays*, Oxford University Press, 1996.

**15ENG232                      INSIGHTS INTO LIFE THROUGH                      1 0 2 2**  
**ENGLISH LITERATURE**

**OBJECTIVES:** To expose the students to different genres of Literature; to hone reading skills; to provide deeper critical and literary insights; to enhance creative thinking; to promote aesthetic sense.

**Unit 1 Poems**

1. W. H. Auden: Refugee Blues; 2. A. K. Ramanujan: Obituary; 3. William Blake: The Little Black Boy; 4. Gieve Patel: Grandparents at a Family Get-together.

**Unit 2 Short Stories**

1. Chinua Achebe: Marriage is a Private Affair; 2. Ruskin Bond: The Thief; 3. Isai Tobolsky: Not Just Oranges; 4. K A Abbas: The Refugee

**Unit 3 Prose**

1. A G Gardiner: On The Philosophy of Hats; 2. Robert Lynd: Mispronunciation

Practicals:

Role plays: The Proposal, Chekov / Remember Ceaser, Gordon Daviot / Final Solutions, Mahesh Dattani, Book reviews, Movie reviews.

**SUGGESTED READING:** *The Old Man and the Sea, Hemingway / Any one of the novels of R. K. Narayan, etc.*

**15ENG233                      TECHNICAL COMMUNICATION                      1 0 2 2**

**OBJECTIVES:** To introduce the students to the elements of technical style; to introduce the basic elements of formal correspondence; to introduce technical paper writing skills and methods of documentation; to improve oral presentation skills in formal contexts.

**Unit 1**

Mechanics of writing: Grammar rules – punctuation - spelling rules - tone and style - graphical Representation.

**Unit 2**

Different kinds of written documents: Definitions – descriptions – instructions – recommendations - manuals - reports – proposals; Formal Correspondence: Letter Writing including job applications with Resume.

**Unit 3**

Technical paper writing: Library research skills - documentation style - document editing – proof reading – formatting.

Practice in oral communication and Technical presentations

**REFERENCES:**

1. Hirsh, Herbert. L. "Essential Communication Strategies for Scientists, Engineers and Technology Professionals". II Edition. New York: IEEE press, 2002
2. Anderson, Paul. V. "Technical Communication: A Reader-Centred Approach". V Edition. Harcourt Brace College Publication, 2003
3. Strunk, William Jr. and White. E B. "The Elements of Style" New York. Alliyen & Bacon, 1999.
4. Riordan, G. Daniel and Pauley E. Steven. "Technical Report Writing Today" VIII Edition (Indian Adaptation). New Delhi: Biztantra, 2004.

**15ENG234                      INDIAN SHORT STORIES IN ENGLISH                      1 0 2 2**

**OBJECTIVES:** To help the students learn the fine art of story writing; to help them learn the techniques of story telling; to help them study fiction relating it to the socio- cultural aspects of the age; to familiarize them with different strategies of reading short stories; to make them familiar with the morals and values held in high esteem by the ideals of Indianness.

**Unit 1**

Introduction: Differences between novel and short stories – origin and development of short stories - Rabindranath Tagore: Kabuliwallah; Mulk Raj Anand: The Gold Watch.

**Unit 2**

R. K. Narayan: Sweets for Angels; K. A. Abbas: The Refugee; Khushwant Singh: The Mark of Vishnu.

**Unit 3**

Masti Venkatesha Iyengar: The Curds-Seller; Manohar Malgonkar: Upper Division Love; Romila Thapar: The Spell; Premchand: The Voice of God.

**TEXT:**

M. G. Narasimha Murthy (ed), *Famous Indian Stories*. Hyderabad: Orient Black Swan, 2014

**REFERENCE:**

Mohan Ramanan (Ed), *English and the Indian Short Story: Essays in Criticism*, Hyderabad, Orient Black Swan, 2000.

**15ENV300 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY 3 0 0 3**

**Unit 1**

State of Environment and Unsustainability, Need for Sustainable Development, Traditional conservation systems in India, People in Environment, Need for an attitudinal

change and ethics, Need for Environmental Education, Overview of International Treaties and Conventions, Overview of Legal and Regulatory Frameworks.

Environment: Abiotic and biotic factors, Segments of the Environment, Biogeochemical Cycles, Ecosystems (associations, community adaptations, ecological succession, Food webs, Food chain, ecological pyramids), Types of Ecosystems – Terrestrial ecosystems, Ecosystem Services, Economic value of ecosystem services, Threats to ecosystems and conservation strategies.

Biodiversity: Species, Genetic & Ecosystem Diversity, Origin of life and significance of biodiversity, Value of Biodiversity, Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation (Hotspots) & Protected Area Network, Community Biodiversity Registers. Threats to Biodiversity, Red Data book, Rare, Endangered and Endemic Species of India. Conservation of Biodiversity. People's action.

Impacts, causes, effects, control measures, international, legal and regulatory frameworks of: Climate Change, Ozone depletion, Air pollution, Water pollution, Noise pollution, Soil / land degradation / pollution

### Unit 2

Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology. Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.

Discuss the interrelation of environmental issues with social issues such as: Population, Illiteracy, Poverty, Gender equality, Class discrimination, Social impacts of development on the poor and tribal communities, Conservation movements: people's movements and activism, Indigenous knowledge systems and traditions of conservation.

### Unit 3

Common goods and public goods, natural capital / tragedy of commons, Cost benefit analysis of development projects, Environment Impact Assessment (EIA), Environment Management Plan (EMP), Green business, Eco-labeling, Problems and solutions with case studies.

Global and national state of housing and shelter, Urbanization, Effects of unplanned development case studies, Impacts of the building and road construction industry on the environment, Eco-homes / Green buildings, Sustainable communities, Sustainable Cities.

Ethical issues related to resource consumption, Intergenerational ethics, Need for investigation and resolution of the root cause of unsustainability, Traditional value systems of India, Significance of holistic value-based education for true sustainability.

### TEXTBOOKS / REFERENCES:

1. R. Rajagopalan, *Environmental Studies: From Crisis to Cure*. Oxford University Press, 2011, 358 pages. ISBN: 9780198072089.
2. Daniel D. Chiras, *Environmental Science*. Jones & Bartlett Publishers, 01-Feb-2012, 669 pages. ISBN: 9781449645311.
3. Andy Jones, Michel Pimbert and Janice Jiggins, 2011. *Virtuous Circles: Values, Systems, Sustainability*. IIED and IUCN CEESP, London. URL: <http://pubs.iied.org/pdfs/G03177.pdf>
4. Annenberg Learner, *The Habitable Planet*, Annenberg Foundation 2015. URL: <http://www.learner.org/courses/envsci/unit/pdfs/textbook.pdf>.

## 15FRE230 PROFICIENCY IN FRENCH LANGUAGE (LOWER) 1 0 2 2

### Unit 1 Population - Identity

How to introduce yourself (name, age, address, profession, nationality); Numbers; How to ask questions;

Grammar – Pronouns - subjects; Regular verbs of 1st group (er) in the present; Être (to be) and avoir (to have) in the present; Interrogative sentence; Gender of adjectives.

### Unit 2 The suburbs - At the train station

Introduce someone; Buy a train ticket or a cinema ticket; Ask for information; Official time; Ask for a price; The city (church, town hall, post office...)

Grammar – Pronouns - subjects (continuation); Gender of adjectives (continuation); Plural of nouns and adjectives; Definite and indefinite articles; Interrogative adjectives; I would like (Je voudrais).

### Unit 3 Paris and the districts - Looking for a room

Locate a room and indicate the way; Make an appointment; Give a price; Ordinal numbers; Usual time; Ask for the time.

Grammar - Imperative mode; Contracted articles (au, du, des); negation.

### TEXTBOOK:

*Metro St Michel* - Publisher: CLE international

**15FRE231 PROFICIENCY IN FRENCH LANGUAGE (HIGHER) 1 0 2 2**

**Unit 1 The first room of a student**

A party to celebrate the 1st room; Description of a room; furniture; Locate objects: prepositions (devant, derrière, dans...), Read advertisement; Appreciation (I like, I prefer).

Grammar - Perfect past tense with avoir; Possessive adjectives (mon, ton, son...); Demonstrative adjectives (ce, cet, cette); Yes (oui, si).

**Unit 2 Small jobs**

Conversation on the phone; Give Time indications; Answer a job offer; Describe a job; Suggest a meeting time.

Grammar - Perfect past tense with être and avoir (continuation); Possessive adjectives (notre, votre, leur); Prepositions (à, pour, avec ...); Pronoun as direct object (le, la, l', les).

**Unit 3 University Restaurant**

Inquiry; Express an opinion; Ask questions (continuation); Food, meals, taste, preferences; Nutrition, diet, choose a menu or diet, Expression of quantities (beaucoup, peu).

Grammar - Partitif (expressing quantity) (du, de la, pas de...); Comparison (plus ...que, moins...que, autant ...que); Interrogation (continuation), inversion, Est-ce que, qu'est-ce que?.

**TEXTBOOK:**

*Metro St Michel - Publisher: CLE International*

**15GER230 GERMAN FOR BEGINNERS I 1 0 2 2**

**Unit 1**

Greetings; Introducing one-self (formal and informal context), saying their name, origin, living place, occupation.

Numbers 1-100; Saying the telephone number.

Countries and Languages.

Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles.

Vocabulary: Professions.

**Unit 2**

Giving the personal details. Name, age, marital status, year of birth, place of birth, etc.

Numbers till 1000. Saying a year.

Alphabets – spelling a word.

Filling up an application form; In the restaurant – making an order.

Grammar: Definite, indefinite and negative article in nominative. Accusative: indefinite and negative Article

Vocabulary: Food items

**Unit 3**

Numbers above 1000. Orientation in Shopping plazas: asking the price, where do I find what, saying the opinion.

Grammar: Accusative – definite article. Adjectives and plural forms.

Vocabulary: Furniture and currencies.

**15GER231 GERMAN FOR BEGINNERS II 1 0 2 2**

**Unit 1**

Shopping and orientation in supermarket; Conversation between the customer and salesman; Where one finds what in supermarket; Asking for requests and suggestions.

Grammar: Dative of personal pronouns. Imperative form.

Vocabulary: Consumables and measurements;

**Unit 2**

Appointments; Work and leisure time activities; Time, weekdays, months and seasons; saying the date; fixing up an appointment.

Grammar: Modal verbs; Prepositions with time and place; Ordinal numbers.

Vocabulary: Leisure activities, weekdays, months and seasons.

**Unit 3**

Family and household; Family and relations; household and daily routine.

Grammar: Possessive articles; Divisible and indivisible verbs.

Vocabulary: Family circle; Household articles.

**15GER232 PROFICIENCY IN GERMAN LANGUAGE (LOWER) 1 0 2 2**

To have an elementary exposure to German language; specifically

1. to have some ability to understand simple spoken German, and to be able to speak it so as to be able to carry on life in Germany without much difficulty (to be able to do shopping, etc.);
2. to be able to understand simple texts, and simple forms of written communication;
3. to have a basic knowledge of German grammar;
4. to acquire a basic vocabulary of 500 words;
5. to be able to translate simple letters with the use of a dictionary; and
6. to have some familiarity with the German life and culture.

(This will not be covered as part of the regular classroom teaching; this is to be acquired by self-study.)

Some useful websites will be given.

**15GER233 PROFICIENCY IN GERMAN LANGUAGE (HIGHER) 1 0 2 2**

The basic vocabulary and grammar learned in the earlier course is mostly still passive knowledge. The endeavour of this course is to activate this knowledge and develop the skill of communication.

Topics are: Airport, railway station, travelling; shopping; invitations, meals, meeting people; around the house; the human body; colours; professions.

Past and future tenses will be introduced. Applying genitive, dative and accusative.

Some German culture. Films.

**15HIN101 HINDI I 1 0 2 2**

**OBJECTIVES:** To teach Hindi for effective communication in different spheres of life - Social context, Education, governance, Media, Business, Profession and Mass communication.

**Unit 1**

Introduction to Hindi Language, National Language, Official Language, link Language etc. Introduction to Hindi language, Devanagari script and Hindi alphabet.

Shabda Bhed, Roopanthar ki Drishti se- Bhasha – Paribhasha aur Bhed - Sangya - Paribhasha Aur Bhed - Sangya ke Roopanthar - kriya.

**Unit 2**

Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender& number - General vocabulary for conversations in given context – understanding proper pronunciation – Conversations, Interviews, Short speeches.

**Unit 3**

Poems – Kabir 1st 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada

**Unit 4**

Letter writing – personal and Formal – Translation from English to Hindi.

**Unit 5**

Kahani – Premchand: Kafan, Abhilasha, Vidroh, Poos ki rath, Juluos.

**BOOKS:**

1. Prem Chand Ki Srvarshrestha Kahaniyam: Prem Chand; Diamond Pub Ltd. New Delhi
2. Vyavaharik Hindi Vyakaran ,Anuvad thaha Rachana : Dr. H. Parameswaran, Radhakrishna publishing House, New Delhi
3. Kamtha Prasad Guru : Hindi Vyakaran, Best Book pub House, New Delhi
4. Poetry : Kavya Ras - Ed: T.V. Basker - Pachouri Press; Mathura

**15HIN111 HINDI II 1 0 2 2**

**OBJECTIVES:** Appreciation and assimilation of Hindi Literature both drisy & shravya using the best specimens provided as anthology.

**Unit 1**

Kavya Tarang; Dhumiil ke Anthim Kavitha [Poet-Dhumiil]; Dhabba [Poet-Kedarnath Singh]; Proxy [Poet-Venugopal]; Vakh [Poet-Arun Kamal]; Maachis [Poet-Suneeta Jain].

**Unit 2**

Communicative Hindi - Moukhik Abhivyakthi

**Unit 3**

Audio-Visual Media in Hindi – Movies like Tare Zameen par, Paa, Black etc., appreciation and evaluation. News reading and presentations in Radio and TV channels in Hindi.

**Unit 4**

Gadya Manjusha – Budhapa, Kheesa, Sadachar ka Thavis

**Unit 5**

Translation: Theory and Practice - Letter writing: Formal and Personal – Introduction to Hindi Software.

**BOOKS:**

1. *Kavay Tarang: Dr. Niranjan, Jawahar Pusthakalay, Mathura.*
2. *Gadya Manjusha: Editor: Govind, Jawahar Pusthakalay, Mathura*

**15HUM230****EMOTIONAL INTELLIGENCE****2 0 0 2****Unit 1**

Emotional Intelligence: Concept of Emotional Intelligence, Understanding the history and origin of Emotional Intelligence, Contributors to Emotional Intelligence, Science of Emotional Intelligence, EQ and IQ, Scope of Emotional Intelligence.

**Unit 2**

Components of Emotional Intelligence: Self-awareness, Self-regulation, Motivation, Empathy, Social skills. Emotional Intelligence Competencies, Elements of Emotional Intelligence, Models of Emotional Intelligence: The Ability-based Model, The Trait Model of Emotional Intelligence, Mixed Models of Emotional Intelligence.

**Unit 3**

Emotional Intelligence at Work place: Importance of Emotional Intelligence at Work place? Cost-savings of Emotional Intelligence, Emotionally Intelligent Leaders, Case Studies Measuring Emotional Intelligence: Emotionally Intelligence Tests, Research on Emotional Intelligence, Developing Emotional Intelligence.

**REFERENCES:**

1. Daniel Goleman (1996). *Emotional Intelligence- Why it can Matter More than IQ.* Bantam Doubleday Dell Publishing Group
2. Daniel Goleman (2000). *Working with Emotional Intelligence.* Bantam Doubleday Dell Publishing Group
3. Liz Wilson, Stephen Neale & Lisa Spencer-Arnell (2012). *Emotional Intelligence Coaching.* Kogan Page India Private Limited

**15HUM231****GLIMPSSES INTO THE INDIAN MIND:  
THE GROWTH OF MODERN INDIA****2 0 0 2****Unit 1**

Introduction

General Introduction; 'His + Story' or 'History' ?; The concepts of 'nation', 'national identity' and 'nationalism'; Texts and Textualities: Comparative Perspectives.

**Unit 2**

Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:

Raja Ram Mohan Roy; Dayananda Saraswati; Bal Gangadhar Tilak; Rabindranath Tagore;

**Unit 3**

Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:

Swami Vivekananda; Sri Aurobindo; Ananda K. Coomaraswamy; Sister Nivedita; Mahatma Gandhi; Jawaharlal Nehru; B.R. Ambedkar; Sri Chandrasekharendra Saraswati, the Paramacharya of Kanchi; Dharampal; Raja Rao; V.S. Naipaul.

Conclusion.

**REFERENCES:**

1. *Tilak, Bal Gangadhar. The Orion / Arctic Home in the Vedas.*
2. *Tagore, Rabindranath. The History of Bharatavarsha / On Nationalism / Greater India.*
3. *Vivekananda, Swami. "Address at the Parliament of Religions"/"The Future of India"/"In Defence of Hinduism" from Selections from the Complete Works of Swami Vivekananda.*
4. *Aurobindo, Sri. The Renaissance in India / On Nationalism.*
5. *Coomaraswamy, Ananda K. Essays in Indian Idealism (any one essay) / Dance of Shiva.*
6. *Nivedita, Sister. "Noblesse Oblige: A Study of Indian Caste" / "The Eastern Mother" from The Web of Indian Life.*
7. *Gandhi, Mahatma. Hind Swaraj.*
8. *Nehru, Jawaharlal. "The Quest" from Discovery of India.*
9. *Ambedkar, B. R. "Buddha and His Dhamma" from Collected Works.*
10. *Saraswati, Chandrasekharendra. "The Sastras and Modern Life" from The Hindu Dharma.*
11. *Dharampal. Bharatiya Chitta, Manas and Kala / Understanding Gandhi.*
12. *Naipaul, V. S. India: A Wounded Civilization / India: A Million Mutinies Now.*

**15HUM232****GLIMPSSES OF ETERNAL INDIA****2 0 0 2****Unit 1**

Introduction

A peep into India's glorious past

Ancient India – the vedas, the vedic society and the Sanatana Dharma – rajamandala and the Cakravartins – Ramarajya – Yudhisthira's ramarajya; Sarasvati - Sindhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmanya Dharma and the rise of Jainism and Buddhism – the sixteen Mahajanapadas and the beginning of Magadhan paramountcy – Kautilya and his Arthashastra – Chandragupta Maurya and the rise of the Mauryan



empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harsavardhana; Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region; The coming of Islam – dismantling of the traditional Indian polity – the Mughal empire – Vijayanagara samraja and days of Maratha supremacy.

### Unit 2

India's contribution to the world: spirituality, philosophy and sciences  
Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy; Ancient Indian science and technology.

The arrival of Europeans, British paramountcy and colonization  
What attracted the rest of the world to India?; India on the eve of the arrival of European merchants; The story of colonization and the havoc it wrecked on Indian culture and civilization; Macaulay and the start of the distortion of Indian education and history; Indian economy – before and after colonization: a brief survey; The emergence of modern India.

### Unit 3

Women in Indian society  
The role and position of women in Hindu civilization; Gleanings from the Vedas, Brihadarnyaka Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya's Arthashastra and Mricchhakatikam of Sudraka; The role and position of Indian women vis-a-vis Islam and European cultures; The great women of India.

### Modern India

The national movement for freedom and social emancipation; Swami Vivekananda, Sri Aurobindo, Rabindranath Tagore; Understanding Mahatma Gandhi; A new nation is born as a republic – the pangs of birth and growth; India since Independence – the saga of socio-political movements; Problems facing the nation today; Globalization and Indian Economy; Bharatavarsha today and the way ahead: Regeneration of Indian National Resources.

### Conclusion

The Wonder that was India; The 'politics' and 'purpose' of studying India.

### REFERENCES:

1. Parameswaran, S. *The Golden Age of Indian Mathematics*. Kochi: Swadeshi Science Movement.
2. Somayaji, D. A. *A Critical Study of Ancient Hindu Astronomy*. Dharwar: 1972.

3. Sen, S. N. & K. V. Sarma eds. *A History of Indian Astronomy*. New Delhi, 1985.
4. Rao, S. Balachandra. *Indian Astronomy: An Introduction*. Hyderabad: Universities Press, 2000.
5. Bose, D. M. et. al. *A Concise History of Science in India*. New Delhi: 1971.
6. Bajaj, Jitendra & M. D. Srinivas. *Indian Economy and Polity*. Chennai: Centre for Policy Studies.
7. Bajaj, Jitendra & M. D. Srinivas. *Timeless India, Resurgent India*. Chennai: Centre for Policy Studies.
8. Joshi, Murl Manohar. *Science, Sustainability and Indian National Resurgence*. Chennai: Centre for Policy Studies, 2008.
9. *The Cultural Heritage of India*. Kolkata: Ramakrishna Mission Institute of Culture.
10. Vivekananda, Swami. *Selections from the Complete Works of Swami Vivekananda*. Kolkata: Advaita Ashrama.
11. Mahadevan, T. M. P. *Invitations to Indian Philosophy*. Madras: University of Madras.
12. Hiriyanna, M. *Outlines of Indian Philosophy*. Motilal Banarsidass.
13. Tagore, Rabindranath. *The History of Bharatavarsha / On Nationalism / Greater India*.
14. Majumdar, R. C. et. al. *An Advanced History of India*. Macmillan.
15. Mahajan, V. D. *India Since 1526*. New Delhi: S. Chand & Company.
16. Durant, Will. *The Case for India*. Bangalore: Strand Book Stall, 2008.
17. Aurobindo, Sri. *The Indian Renaissance / India's Rebirth / On Nationalism*.
18. Nivedita, Sister. *The Web of Indian Life*. Kolkata: Advaita Ashrama.
19. Durant, Will. *The Story of Civilization. Volume 1 – Our Oriental Heritage*. New York: Simon & Schuster.
20. Ranganathananda, Swami. *Eternal Values for A Changing Society*. Bombay: Bharatiya Vidya Bhavan.
21. Ranganathananda, Swami. *Universal Message of the Bhagavad Gita*. Kolkata: Advaita Ashrama.
22. Seturaman, V. S. *Indian Aesthetics*. Macmillan.
23. Coomaraswamy, Ananda K. *The Dance of Shiva*. New Delhi: Sagar Publications.
24. Coomaraswamy, Ananda K. *Essays on Indian Idealism*. New Delhi: Munshiram Manoharlal.
25. Danino, Michel. *The Invasion That Never Was*.
26. Kautilya. *Arthashastra*.
27. Altekar, A. S. *State and Government in Ancient India*. New Delhi: Motilal Banarsidass.
28. Altekar, A. S. *The Position of Women in Hindu Civilization*. New Delhi: Motilal Banarsidass.
29. Sircar, D. C. *Studies in the Religious Life of Ancient and Medieval India*. New Delhi: Motilal Banarsidass.
30. Sircar, D. C. *Studies in the Political and Administrative Systems in Ancient and Medieval Times*. New Delhi: Motilal Banarsidass.
31. Madhavananda, Swami & R. C. Majumdar eds. *The Great Women of India*. Kolkata: Advaita Ashrama.
32. Dutt, R. C. *The Economic History of India*. London, 1902.
33. Dharampal. *Collected Works*.
34. Dharampal. *Archival Compilations (unpublished)*

**15HUM233 GLIMPSES OF INDIAN ECONOMY AND POLITY 2 0 0 2****Unit 1**

## Introduction

General Introduction; Primitive man and his modes of exchange – barter system; Prehistoric and proto-historic polity and social organization.

Ancient India – up to 600 B.C.

Early India – the vedic society – the varnashramadharmā – socio-political structure of the various institutions based on the four purusharthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramarajya) – Yudhishthira's ramarajya; Sarasvati - Sindhu civilization and India's trade links with other ancient civilizations; Towards chiefdoms and kingdoms – transformation of the polity: kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of the Indo-Gangetic plain.

**Unit 2**

Classical India: 600B.C. – 1200 A.D.

The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya's Arthashastra; of Politics and trade – the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India's maritime trade; Dharma at the bedrock of Indian polity – the concept of Digvijaya: dharma-vijaya, lobha-vijaya and asura-vijaya; Glimpses into the south Indian economies: political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas

Medieval India: 1200 A.D. – 1720 A.D.

Advent of Islam – changes in the social institutions; Medieval India – agrarian economy, non-agricultural production and urban economy, currency system; Vijayanagara samrajya and maritime trade – the story of Indian supremacy in the Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

**Unit 3**

Modern India: 1720 - 1947

the Indian market and economy before the arrival of the European traders; Colonisation and British supremacy (dismantling of everything that was 'traditional' or 'Indian') – British attitude towards Indian trade, commerce and economy and the resultant ruining of Indian economy and business – man-made famines – the signs

of renaissance: banking and other business undertakings by the natives (the members of the early Tagore family, the merchants of Surat and Porbander, businessmen of Bombay, etc. may be referred to here) – the evolution of the modern banking system; Glimpses into British administration of India and administrative models; The National movement and nationalist undertakings in business and industry: the Tatas and the Birlas; Modern India: the growth of large-scale industry – irrigation and railways – money and credit – foreign trade; Towards partition – birth of two new nations – division of property; The writing of the Indian Constitution – India becomes a democratic republic – a new polity is in place.

Independent India – from 1947

India since Independence – the saga of socio-political movements; Indian economy since Independence – the fiscal system – the five year plans – liberalisation – the GATT and after; Globalisation and Indian economy; Impact of science and (new/emerging) technology on Indian economy; Histories of select Indian business houses and business entrepreneurship.

Conclusion

**REFERENCES:**

1. *The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.*
2. *Kautilya. Arthashastra.*
3. *Altekar, A. S. State and Government in Ancient India. New Delhi: Motilal Banarsidass.*
4. *Sircar, D. C. Studies in the Political and Administrative Systems in Ancient and Medieval Times. New Delhi: Motilal Banarsidass.*
5. *Dutt, R. C. The Economic History of India. London, 1902.*
6. *Dharampal. Collected Works (Volumes IV & V).*
7. *Dharampal. Archival Compilations (unpublished).*
8. *Bajaj, Jitendra & M. D. Srinivas. Indian Economy and Polity. Chennai: Centre for Policy Studies.*
9. *Bajaj, Jitendra & M. D. Srinivas. Timeless India, Resurgent India. Chennai: Centre for Policy Studies.*
10. *Joshi, Murlī Manohar. Science, Sustainability and Indian National Resurgence. Chennai: Centre for Policy Studies, 2008.*
11. *Tripathi, Dwijendra. The Oxford History of Indian Business. New Delhi: Oxford University Press, 2004.*
12. *McGuire, John, et al, eds. Evolution of World Economy, Precious Metals and India. New Delhi: Oxford University Press, 2001.*
13. *Tripathi, Dwijendra and Jyoti Jumani. The Concise Oxford History of Indian Business. New Delhi: Oxford University Press, 2007.*
14. *Kudaisya, Medha M. The Life and Times of G. D. Birla. New Delhi: Oxford University Press, 2003.*
15. *Raychaudhuri, Tapan and Irfan Haib, eds. The Cambridge Economic History of India. Volume 1. New Delhi: Orient Longman, 2004.*

16. Kumar, Dharma, ed. *The Cambridge Economic History of India. Volume 2.* New Delhi: Orient Longman, 2005.
17. Sabavala, S. A. and R. M. Lala, eds. *J. R. D. Tata: Keynote.* New Delhi: Rupa & Co., 2004.
18. Mambro, Arvind ed. *J. R. D. Tata: Letters.* New Delhi: Rupa & Co., 2004.
19. Lala, R M, *For the Love of India The Life and Times of J.R.D. Tata* New Delhi: Penguin, 2006
20. Thapar, Romila *The Penguin History of Early India: From the Origins to AD 1300.* New Delhi Penguin, 2002
21. Majumdar, R C, et. al. *An Advanced History of India* Macmillan

**15HUM234 HEALTH AND LIFE STYLE 1 0 2 2**

**Unit 1 Introduction to Health**

Health is wealth; Role of lifestyle habits on health; Importance of adolescence; Stages, Characteristics and changes during adolescence; Nutritional needs during adolescence why healthy lifestyle is important for adolescence. Eating Habits - eating disorders, skipping breakfast, junk food consumption.

*Practicals - Therapeutic Diets*

**Unit 2 Food and Nutritional Requirements during Adolescence**

Fluid intake; nutrition related problems; lifestyle related problems, Role of physical activity; resting pattern and postures, Personal habits – alcoholism, and other tobacco products, electronic addiction etc

*Practicals - Ethnic Foods*

**Unit 3 Need for a Positive Life Style Change**

Peer pressure & procrastination, Stress, depression, suicidal tendency, Mini project review and viva, Whole portions revision.

*Practical - Cooking without Fire or Wire-healthy Snacks*

**TEXTBOOKS:**

1. B. Srilakshmi, "Dietetics", New age international (P) Ltd, publishers, 2010.
2. "Nutrient requirement and Recommended Dietary Allowances for Indians", published by Indian Council of Medical Research, ICMR, 2010.

**REFERENCE BOOKS:**

1. K Park "Textbook of preventive and social medicine", 2010.
2. WHO Report on Adolescent Health: 2010

**15HUM235 INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY 2 0 0 2**

**Unit 1**

Introductory study of the Bhagavad Gita and the Upanishads.

**Unit 2**

The relevance of these classics in a modern age.

**Unit 3**

Goals of human life - existential problems and their solutions in the light of these classics etc.

**REFERENCE:**

*The Bhagavad Gita, Commentary by Swami Chinmayananda*

**15HUM236 INTRODUCTION TO INDIA STUDIES 2 0 0 2**

**PREAMBLE:** This paper will introduce the students to the multiple dimensions of the contribution of India to the fields of philosophy, art, literature, physical and social sciences. The paper intends to give an insight to the students about the far-reaching contributions of India to world culture and thought during the course of its long journey from the hoary antiquity to the present times. Every nation takes pride in its achievements and it is this sense of pride and reverence towards the achievements that lays the foundation for its all-round progress.

**Unit 1**

A brief outline of Indian history from prehistoric times to the present times.

Contributions of India to world culture and civilization: Indian Philosophy and Religion; Art and Literature; Physical and Social Sciences.

**Unit 2**

Modern India: Challenges and Possibilities.

Scientific and technological progress in post-independence era; Socio-cultural and political movements after independence; Challenges before the nation today - unemployment – corruption – degradation of cultural and moral values - creation of a new system of education; Creation of a modern and vibrant society rooted in traditional values.

**Unit 3**

Modern Indian Writing in English: Trends in Contemporary Indian Literature in English.

**TEXTBOOK:**

Material given by the Faculty

**BACKGROUND LITERATURE:**

- 1 Selections from The Cultural Heritage of India, 6 volumes, Ramakrishna Mission Institute of Culture (Kolkata) publication.
- 2 Selections from the Complete Works of Swami Vivekananda, Advaita Ashrama publication.
- 3 Invitations to Indian Philosophy, T. M. P. Mahadevan, University of Madras, Chennai.
- 4 Outlines of Indian Philosophy, M. Hiriyanna, MLBD.
- 5 An Advanced History of India, R. C. Majumdar et al, Macmillan.
- 6 India Since 1526, V. D. Mahajan, S. Chand & Company
- 7 The Indian Renaissance, Sri Aurobindo.
- 8 India's Rebirth, Sri Aurobindo.
- 9 On Nationalism, Sri Aurobindo.
- 10 The Story of Civilization, Volume I: Our Oriental Heritage, Will Durant, Simonand Schuster, New York.
- 11 Eternal Values for a Changing Society, Swami Ranganathananda, Bharatiya Vidya Bhavan.
- 12 Universal Message of the Bhagavad Gita, Swami Ranganathananda, Advaita Ashrama.
- 13 Awaken Children: Conversations with Mata Amritanandamayi
- 14 Indian Aesthetics, V. S. Seturaman, Macmillan.
- 15 Indian Philosophy of Beauty, T. P. Ramachandran, University of Madras, Chennai.
- 16 Web of Indian Thought, Sister Nivedita
- 17 Essays on Indian Nationalism, Anand Kumaraswamy
- 18 Comparative Aesthetics, Volume 2, Kanti Chandra Pandey, Chowkhamba, Varanasi
- 19 The Invasion That Never Was, Michel Danino
- 20 Samskara, U. R. Ananthamurthy, OUP.
- 21 Hayavadana, Girish Karnard, OUP.
- 22 Naga-Mandala, Girish Karnard, OUP.

### 15HUM237 INTRODUCTION TO SANSKRIT LANGUAGE AND LITERATURE 2 0 0 2

**OBJECTIVES:** To familiarize students with Sanskrit language; to introduce students to various knowledge traditions in Sanskrit; to help students appreciate and imbibe India's ancient culture and values.

**Unit 1**

Sanskrit Language – Vakya Vyavahara (प्रथमादीक्षा) - Introduction to Sanskrit language - Devanagari script and Sanskrit alphabet - Vowels and Consonants – Pronunciation - Classification of Consonants – Samyukthakshara Words – Nouns and Verbs - Cases – Introduction to Numbers and Time – Verbs: Singular, Dual and Plural – SarvaNamas: First Person, Second Person, Third Person – Tenses: Past, Present and Future -Words for Communication – Selected Slokas – MoralStories – Subhashithas – Riddles.

**Unit 2**

Language Studies - Role of Sanskrit in Indian & World Languages.

**Unit 3**

Introduction to Sanskrit Classical Literature – KavyaTradition – Drama Tradition - Stotra Tradition – Panchatantra Stories.

**Unit 4**

Introduction to Sanskrit Technical Literature – Astronomy – Physics – Chemistry – Botany – Engineering – Aeronautics – Ayurveda – Mathematics – Medicine – Architecture - Tradition of Indian Art – Administration – Agriculture.

**Unit 5**

Indology Studies – Perspectives and Innovations.

**TEXTBOOKS AND REFERENCE BOOKS:**

1. Vakya Vyavahara- Prof. Vempaty Kutumba Sastri, Rashtriya Sanskrit Sansthan, New Delhi
2. The Wonder that is Sanskrit - Dr.Sampadananda Mishra, New Delhi
3. Science in Sanskrit – Samskritha Bharathi, NewDelhi

**15HUM238****NATIONAL SERVICE SCHEME****2 0 0 2****Unit 1**

Introduction to Basic Concepts of NSS: History, philosophy, aims and objectives of NSS, Emblem, flag, motto, song, badge etc., Organisational structure, roles and responsibilities of various NSS functionaries.

NSS Programmes and Activities: Concept of regular activities, special campaigning, Day Camps, Basis of adoption of village / slums, methodology of conducting survey, financial pattern of the scheme, other youth programme/schemes of GOI, Coordination with different agencies, Maintenance of the Diary.

**Unit 2**

Volunteerism and Shramdan: Indian Tradition of volunteerism, Needs and importance of volunteerism, Motivation and Constraints of volunteerism, Shramdan as part of volunteerism, Amalabharatam Campaign, Swatch Bharath.

**Unit 3**

Understanding youth: Definition, profile and categories of youth, Issues, challenges and opportunities for youth, Youth as an agent of social change.

Youth and Yoga: History, philosophy and concept of Yoga, Myths and misconceptions about Yoga, Different Yoga traditions and their impacts, Yoga as a preventive and curative method, Yoga as a tool for healthy life style

**Unit 4**

Youth Development Programmes in India: National Youth Policy, Youth development programmes at the national level, state level and voluntary sector, youth-focused and youth-led organizations.

Youth and Crime: Sociological and psychological factors influencing youth crime, Peer mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice.

**Unit 5**

Environmental Issues: Environment conservation, enrichment and sustainability, climate change, waste management, rain water harvesting, energy conservation, waste land development.

Project Work / Practical

**15HUM239      PSYCHOLOGY FOR EFFECTIVE LIVING      2 0 0 2**

**Unit 1 Self-Awareness & Self-Motivation**

Self analysis through SWOT, Johari Window, Maslow's hierarchy of motivation, importance of self esteem and enhancement of self esteem.

**Unit 2 The Nature and Coping of Stress**

Conflict, Relationship issues, PTSD. Stress – stressors – eustress - distress, coping with stress, stress management techniques.

**Unit 3 Application of Health Psychology**

Health compromising behaviours, substance abuse and addiction.

**TEXTBOOKS:**

1. V. D. Swaminathan & K. V. Kaliappan "Psychology for effective living - An introduction to Health
2. Psychology. 2nd edition Robert J. Gatchel, Andrew Baum & David S. Krantz, McGraw Hill.

**REFERENCE BOOKS:**

1. S. Sunder, 'Textbook of Rehabilitation', 2nd edition, Jaypee Brothers, New Delhi. 2002.
2. Weiben & Lloyd, 'Psychology applied to Modern Life', Thompson Learning, Asia Ltd.2004.

**15HUM240      PSYCHOLOGY FOR ENGINEERS      2 0 0 2**

**Unit 1**

Psychology of Adolescents: Adolescence and its characteristics.

**Unit 2**

Learning, Memory & Study Skills: Definitions, types, principles of reinforcement, techniques for improving study skills, Mnemonics.

**Unit 3**

Attention & Perception: Definition, types of attention, perception.

**TEXTBOOKS:**

1. S. K. Mangal, "General Psychology", Sterling Publishers Pvt. Ltd.2007
2. Baron A. Robert, "Psychology", Prentice Hall of India. New Delhi 2001

**REFERENCE BOOKS:**

1. Elizabeth B. Hurlock, Developmental Psychology - A life span approach, 6th edition.
2. Feldman, Understanding Psychology, McGraw Hill, 2000.
3. Clifford Morgan, Richard King, John Scholper, "Introduction to Psychology", Tata Mcgraw Hill, Pvt Ltd 2004.

**15HUM241 SCIENCE AND SOCIETY – AN INDIAN PERSPECTIVE 2 0 0 2**

**Unit 1**

Introduction

Western and Indian views of science and technology

Introduction; Francis Bacon: the first philosopher of modern science; The Indian tradition in science and technology: an overview.

**Unit 2**

Indian sciences

Introduction; Ancient Indian medicine: towards an unbiased perspective; Indian approach to logic; The methodology of Indian mathematics; Revision of the traditional Indian planetary model by Nilakantha Somasutvan in circa 1500 AD

Science and technology under the British rule

Introduction; Indian agriculture before modernization; The story of modern forestry in India; The building of New Delhi

**Unit 3**

Science and technology in Independent India

Introduction; An assessment of traditional and modern energy resources; Green

revolution: a historical perspective; Impact of modernisation on milk and oilseeds economy; Planning without the spirit and the determination.

Building upon the Indian tradition

Introduction; Regeneration of Indian national resources; Annamahatmyam and Annam Bahu Kurvita: recollecting the classical Indian discipline of growing and sharing food in plenty and regeneration of Indian agriculture to ensure food for all in plenty.

Conclusion

**REFERENCES:**

1. Joseph, George Gheverghese. *The Crest of the Peacock: Non-European Roots of Mathematics.* London: Penguin (UK), 2003.
2. Iyengar, C. N. Srinivasa. *History of Hindu Mathematics.* Lahore: 1935, 1938 (2 Parts).
3. Amma, T. A. Saraswati. *Geometry in Ancient and Medieval India.* Varanasi: Motilal Banarsidass, 1979.
4. Bag, A. K. *Mathematics in Ancient and Medieval India.* Varanasi: Motilal Banarsidass, 1979.
5. Sarma K. V. & B. V. Subbarayappa. *Indian Astronomy: A Source-Book.* Bombay: Nehru Centre, 1985.
6. Sriram, M. S. et. al. eds. *500 Years of Tantrasangraha: A Landmark in the History of Astronomy.* Shimla: Indian Institute of Advanced Study, 2002.
7. Bajaj, Jitendra & M. D. Srinivas. *Restoring the Abundance: Regeneration of Indian Agriculture to Ensure Food for All in Plenty.* Shimla: Indian Institute of Advanced Study, 2001.
8. Bajaj, Jitendra ed. *Report of the Seminar on Food for All: The Classical Indian Discipline of Growing and Sharing Food in Plenty.* Chennai: Centre for Policy Studies, 2001.
9. Bajaj, Jitendra & M. D. Srinivas. *Annam Bahu Kurvita: Recollecting the Indian Discipline of Growing and Sharing Food in Plenty.* Madras: Centre for Policy Studies, 1996.
10. Parameswaran, S. *The Golden Age of Indian Mathematics.* Kochi: Swadeshi Science Movement.
11. Somayaji, D. A. *A Critical Study of Ancient Hindu Astronomy.* Dharwar: 1972.
12. Sen, S. N. & K. V. Sarma eds. *A History of Indian Astronomy.* New Delhi, 1985.
13. Rao, S. Balachandra. *Indian Astronomy: An Introduction.* Hyderabad: Universities Press, 2000.
14. Bose, D. M. et. al. *A Concise History of Science in India.* New Delhi: 1971.
15. Bajaj, Jitendra & M. D. Srinivas. *Indian Economy and Polity.* Chennai: Centre for Policy Studies.
16. Bajaj, Jitendra & M. D. Srinivas. *Timeless India, Resurgent India.* Chennai: Centre for Policy Studies.
17. Joshi, Murlī Manohar. *Science, Sustainability and Indian National Resurgence.* Chennai: Centre for Policy Studies, 2008.
18. *The Cultural Heritage of India.* Kolkata: Ramakrishna Mission Institute of Culture.

\* The syllabus and the study material in use herein has been developed out of a 'summer programme' offered by the Centre for Policy Studies (CPS), Chennai at the Indian Institute of Advanced Study (IIAS), Rashtrapati Nivas, Shimla, sometime ago. The same has been very kindly made available to us by Professors Dr M.D. Srinivas (Chairman) and Dr J.K. Bajaj (Director) of the CPS.

**15HUM242 THE MESSAGE OF BHAGAVAD GITA 2 0 0 2**

**Unit 1**

Introduction: Relevance of Bhagavad Gita today – Background of Mahabharatha.

ArjunaVishada Yoga: Arjuna's Anguish and Confusion – Symbolism of Arjuna's Chariot.

Sankhya Yoga: Importance of Self-knowledge – Deathlessness: Indestructibility of Consciousness – Being Established in Wisdom – Qualities of a Sthita-prajna.

**Unit 2**

Karma Yoga: Yoga of Action – Living in the Present – Dedicated Action without Anxiety over Results - Concept of Swadharma.

Dhyana Yoga: Tuning the Mind – Quantity, Quality and Direction of Thoughts – Reaching Inner Silence.

**Unit 3**

Bhakti Yoga: Yoga of Devotion – Form and Formless Aspects of the Divine – Inner Qualities of a True Devotee.

GunatrayaVibhaga Yoga: Dynamics of the Three Gunas: Tamas, Rajas, Sattva – Going Beyond the Three Gunas – Description of a Gunatheetha.

**TEXTBOOKS / REFERENCES:**

1. Swami Chinmayananda, "The Holy Geeta", Central Chinmaya Mission Trust, 2002.
2. Swami Chinmayananda, "A Manual of Self Unfoldment", Central Chinmaya Mission Trust, 2001.

**15HUM243 THE MESSAGE OF THE UPANISHADS 2 0 0 2**

**OBJECTIVES:** To give students an introduction to the basic ideas contained in the Upanishads; and explores how their message can be applied in daily life for achieving excellence.

**Unit 1**

An Introduction to the Principal Upanishads and the Bhagavad Gita - Inquiry into the mystery of nature - Sruti versus Smrti - Sanatana Dharma: its uniqueness - The Upanishads and Indian Culture - Upanishads and Modern Science.

**Unit 2**

The challenge of human experience & problems discussed in the Upanishads – the True nature of Man – the Moving power of the Spirit – The Message of Fearlessness – Universal Man - The central problems of the Upanishads – Ultimate reality – the nature of Atman - the different manifestations of consciousness.

**Unit 3**

Upanishad Personalities - episodes from their lives and essential teachings: Yajnavalkya, Aruni, Uddalaka, Pippalada, Satyakama Jabala, Svetaketu, Nachiketas, Upakosala, Chakrayana Ushasti, Raikva, Kapila and Janaka. Important verses from Upanishads - Discussion of Sage Pippalada's answers to the six questions in Prasnopanishad.

**REFERENCES:**

1. *The Message of the Upanishads* by Swami Ranganathananda, Bharatiya Vidya Bhavan
2. *Eight Upanishads with the commentary of Sankaracharya*, Advaita Ashrama
3. *Indian Philosophy* by Dr. S. Radhakrishnan, Oxford University Press
4. *Essentials of Upanishads* by R L Kashyap, SAKSI, Bangalore
5. *Upanishads in Daily Life*, Sri Ramakrishna Math, Myslapore.
6. *Eternal stories of the Upanishads* by Thomas Egenes and Kumuda Reddy
7. *Upanishad Ganga series – Chinmaya Creations*

**15HUM244 UNDERSTANDING SCIENCE OF FOOD AND NUTRITION 1 0 2 2****Unit 1 Food and Food Groups**

Introduction to foods, food groups, locally available foods, Nutrients, Cooking methods, Synergy between foods, Science behind foods, Food allergies, food poisoning, food safety standards.

*Cookery Practicals - Balanced Diet*

**Unit 2 Nutrients and Nutrition**

Nutrition through life cycle, RDA, Nutrition in disease, Adulteration of foods & Food additives, Packaging and labeling of foods.

*Practicals - Traditional Foods*

**Unit 3 Introduction to Food Biotechnology**

Future foods - Organic foods and genetically modified foods, Fortification of food value addition of foods, functional foods, Nutraceuticals, supplementary foods, Processing and preservation of foods, applications of food technology in daily life, and your prospects associated with food industry – Nanoparticles, biosensors, advanced research.

*Practicals - Value added foods*

**TEXTBOOKS:**

1. N. Shakuntalamanay, M. Shadaksharaswamy, "Food Facts and principles", New age international (P) ltd, publishers, 2005.
2. B. Srilakshmi, "Dietetics", New age international (P) ltd, publishers, 2010.

**REFERENCE BOOKS:**

1. B. Srilakshmi, "Food Science", New age international (P) ltd, publishers, 2008.
2. "Nutrient requirement and Recommended Dietary Allowances for Indians", published by Indian Council of Medical Research, ICMR, 2010.

**15JAP230 PROFICIENCY IN JAPANESE LANGUAGE (LOWER) 1 0 2 2**

This paper will introduce the basics of Japanese language. Students will be taught the language through various activities like writing, reading, singing songs, showing Japanese movies etc. Moreover this paper intends to give a thorough knowledge on Japanese scripts that is Hiragana and Katakana. Classes will be conducted throughout in Japanese class only. Students will be able to make conversations with each other in Japanese. Students can make self-introduction and will be able to write letters in Japanese. All the students will be given a text on Japanese verbs and tenses.

Students can know about the Japanese culture and the lifestyle. Calligraphy is also a part of this paper. Informal sessions will be conducted occasionally, in which students can sing Japanese songs, watch Japanese movies, do Origami – pattern making using paper.

**15JAP231 PROFICIENCY IN JAPANESE LANGUAGE (HIGHER) 1 0 2 2**

Students will be taught the third and the most commonly used Japanese script, Kanji. Students will be taught to write as well as speak.

Students will be given detailed lectures on Calligraphy.

This version of the course includes a new project where the students should make a short movie in Japanese language selecting their own topics.

By the end of the semester they the students will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.

**15KAN101****KANNADA I****1 0 2 2**

**OBJECTIVES:** To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech.

**Unit 1**

Adalitha Kannada: bhashe, swaroopa, belavanigeaya kiru parichaya  
Paaribhaashika padagalu  
Vocabulary Building

**Unit 2**

Prabhandha – Vyaaghra Geethe - A. N. Murthy Rao  
Prabhandha – Baredidi...baredidi, Baduku mugiyuvudilla allige...- Nemi Chandra  
Paragraph writing – Development: comparison, definition, cause & effect  
Essay – Descriptive & Narrative

**Unit 3**

Mochi – Bharateepriya  
Mosarina Mangamma – Maasti Venkatesh Iyengar  
Kamalaapurada Hotelnalli – Panje Mangesh Rao  
Kaanike – B. M. Shree  
Geleyanobbanige bareda Kaagada – Dr. G. S. Shivarudrappa  
Moodala Mane – Da. Ra. Bendre  
Swathantryada Hanate – K. S. Nissaar Ahmed

**Unit 4**

Letter Writing - Personal: Congratulation, thanks giving, invitation, condolence

**Unit 5**

Reading Comprehension; nudigattu, gaadegalu

Speaking Skills: Prepared speech, pick and speak

**REFERENCES:**

1. H. S. Krishna Swami Iyengar – Adalitha Kannada – Chetana Publication, Mysuru
2. A. N. Murthy Rao – Aleyuva Mana – Kuvempu Kannada Adyayana Samste
3. Nemi Chandra – Badhuku Badalisabahudu – Navakarnataka Publication
4. Sanna Kathegalu - Prasaranga, Mysuru University , Mysuru
5. B. M. Shree – Kannadada Bavuta – Kannada Sahitya Parishattu
6. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna Book House (P) Ltd.
7. Dr. G. S. Shivarudrappa – Samagra Kavya – Kamadhenu Pustaka Bhavana

**15KAN111****KANNADA II****1 0 2 2**

**OBJECTIVES:** To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to develop functional and creative skills in language; to enable the students to plan, draft, edit & present a piece of writing.

**Unit 1**

Official Correspondence: Adhikrutha patra, prakatane, manavi patra, vanijya patra

**Unit 2**

Nanna Hanate - Dr. G. S. Shivarudrappa  
Mankuthimmana Kaggada Ayda bhagagalu – D. V. Gundappa (Padya Sankhye 5, 20, 22, 23, 25, 44, 344, 345, 346, 601)  
Ella Marethiruvaga - K. S. Nissaar Ahmed  
Saviraru Nadigalu – S Siddalingayya

**Unit 3**

Sayo Aata – Da. Ra. Bendre

**Unit 4**

Sarva Sollegala turtu Maha Samelana - Beechi  
Swarthakkaagi Tyaga - Beechi

**Unit 5**

Essay writing: Argumentative & Analytical  
Précis writing

**REFERENCES:**

1. H. S. Krishnaswami Iyengar – Adalitha Kannada – Chetan Publication, Mysuru
2. Dr. G. S. Shivarudrappa – Samagra Kavya. - Kamadhenu Pustaka Bhavana
3. Shrikanth - Mankuthimmana Kaggada – Taatparya – Sri Ranga Printers & Binders
4. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna book house
5. Dr. Da. Ra. Bendre – Saayo Aata – Shri Maata Publication
6. Beechi – Sahukara Subbamma – Sahitya Prakashana

**15MAL101****MALAYALAM I****1 0 2 2**

**OBJECTIVES:** To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

**Unit 1**

Ancient poet trio: Adhyatmaramayanam,  
Lakshmana Swanthanam (valsa soumitre... mungikidakayal), Ezhuthachan -  
Medieval period classics – Jnanappana (kalaminnu... vilasangalingane), Poonthanam



**Unit 2**

Modern Poet trio: Ente Gurunathan, Vallathol Narayana Menon - Critical analysis of the poem.

**Unit 3**

Short stories from period 1/2/3, Poovanpazham - Vaikam Muhammed Basheer - Literary & Cultural figures of Kerala and about their literary contributions.

**Unit 4**

Literary Criticism: Ithihasa studies - Bharatha Paryadanam - Vyasante Chiri - Kuttikrishna Mararu - Outline of literary Criticism in Malayalam Literature - Introduction to Kutti Krishna Mararu & his outlook towards literature & life.

**Unit 5**

Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation – Thettillatha Malayalam

Writing - a. Expansion of ideas; b. Precis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script / Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

**REFERENCES:**

1. P. K. Balakrishnanan, *Thunjan padhanangal*, D. C. Books, 2007.
2. G. Balakrishnan Nair, *Jnanappanayum Harinama Keerthanavum*, N. B. S, 2005.
3. M. N. Karasser, *Basheerinte Poonkavanam*, D. C. Books, 2008.
4. M. N. Vijayan, *Marubhoomikal Pookkumbol*, D. C. Books, 2010.
5. M. Thomas Mathew, *Lavanyanubhavathinte Yukthisasthram*, National Book Stall, 2009.
6. M. Leelavathy, *Kavitha Sahityacharitam*, National Book Stall, 1998.
7. Thayattu Sankaran, *Vallathol Kavithapadhamam*, D. C. Books, 2004.

**15MAL111 MALAYALAM II 1 0 2 2**

**OBJECTIVES:** To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

**Unit 1**

Ancient poet trio: Kalayanasougandhikam, (kallum marangalun... namukkennarika vrikodara) Kunjan Nambiar - Critical analysis of his poetry - Ancient Drama: Kerala Sakunthalam (Act 1), Kalidasa (Translated by Attor Krishna Pisharody).

**Unit 2**

Modern / romantic / contemporary poetry: Manaswini, Changampuzha Krishna Pillai – Romanticism – modernism.

**Unit 3**

Anthology of short stories from period 3/4/5: Ninte Ormmayku, M. T. Vasudevan Nair - literary contributions of his time

**Unit 4**

Part of an autobiography / travelogue: Kannerum Kinavum, V. T. Bhattathirippadu - Socio-cultural literature - historical importance.

**Unit 5**

Error-free Malayalam - 1. Language; 2. Clarity of expression; 3. Punctuation - Thettillatha Malayalam

Writing - a. Expansion of ideas; b. Précis Writing ; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script / Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

**REFERENCES:**

1. Narayana Pillai. P. K, *Sahitya Panchanan. Vimarsanathrayam*, Kerala Sahitya Academy, 2000
2. Sankunni Nair. M. P, *Chathravum Chamaravum*, D. C. Books, 2010.
3. Guptan Nair. S, *Asthiyude Pookkal*, D. C Books. 2005
4. Panmana Ramachandran Nair, *Thettillatha Malayalam*, Saryum thettum etc., D. C. Book, 2006.
5. M. Achuthan, *Cherukatha-Innale*, innu, National Book Stall, 1998.
6. N. Krishna Pillai, *Kairaliyude Katha*, National Book Stall, 2001.

**15MAT111 CALCULUS AND MATRIX ALGEBRA 2 1 0 3**

**Unit 1 Calculus**

Graphs: Functions and their Graphs. Shifting and Scaling of Graphs.

Limit and Continuity: Limit (One-Sided and Two-Sided) of Functions. Continuous Functions, Discontinuities, Monotonic Functions, Infinite Limits and Limit at Infinity.

**Unit 2** Differentiation and its Applications: Derivative of a function, non-differentiability, Intermediate Value Property, Mean Value Theorem, Extreme Values of Functions, Monotonic Functions, Concavity and Curve Sketching, Integration: Definite Integrals, The Mean Value Theorem for definite integrals, Fundamental Theorem of Calculus, Integration Techniques.

**Unit 3 Matrix Algebra**

Review: System of linear Equations, linear independence

Eigen values and Eigen vectors: Definitions and Properties, Positive definite, Negative Definite and Indefinite Matrices, Diagonalization and Orthogonal Diagonalization, Quadratic form, Transformation of Quadratic Form to Principal axes, Symmetric and Skew Symmetric Matrices, Hermitian and Skew Hermitian Matrices and Orthogonal Matrices Iterative Methods for the Solution of Linear Systems, Power Method for Eigen Values and Eigen Vectors.

**TEXTBOOKS:**

1. 'Calculus', G. B. Thomas Pearson Education, 2009, Eleventh Edition.
2. 'Advanced Engineering Mathematics', Erwin Kreyszig, John Wiley and Sons, 2015, Tenth Edition.

**REFERENCE BOOKS:**

1. 'Calculus', Monty J. Strauss, Gerald J. Bradley and Karl J. Smith, 3rd Edition, 2002.
2. 'Advanced Engineering Mathematics', by Dennis G. Zill and Michael R. Cullen, second edition, CBS Publishers, 2012.

**15MAT121 VECTOR CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS 3 1 0 4**

**Unit 1**

Vector Differentiation: Vector and Scalar Functions, Derivatives, Curves, Tangents, Arc Length, Curves in Mechanics, Velocity and Acceleration, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field. (Sections: 9.4, 9.5, 9.6, 9.9, 9.10, 9.11)

Vector Integration: Line Integral, Line Integrals Independent of Path. Green's Theorem in the Plane (Sections: 10.1, 10.2, 10.3, 10.4).

**Unit 2**

Surface Integral: Surfaces for Surface Integrals, Surface Integrals, Triple Integrals – Gauss Divergence Theorem, Stoke's Theorem. (Sections: 10.5, 10.6, 10.7, 10.9)

First Order Differential Equations: First Order ODE, Exact Differential Equations and Integrating Factors (Sections 1.1 and 1.4).

**Unit 3**

Second Order Differential Equations: Homogeneous and non-homogeneous linear differential equations of second order (Review), Modelling: Free Oscillations,

Euler-Cauchy Equations, Solution by Undetermined Coefficients, Solution by the Method of Variation of Parameters (Sections 2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 2.10).

System of Order Differential Equations: Basic Concepts and Theory, Constant Coefficient systems – Phase Plane method, Criteria for Critical Points, Stability. (Sections 4.1 – 4.4).

**TEXTBOOK:**

'Advanced Engineering Mathematics', Erwin Kreyszig, John Wiley and Sons, Tenth Edition, 2015.

**REFERENCE BOOKS:**

1. 'Advanced Engineering Mathematics', Dennis G. Zill and Michael R. Cullen, second edition, CBS Publishers, 2012.
2. 'Calculus', G. B. Thomas Pearson Education, 2009, Eleventh Edition.
3. 'Calculus', Monty J. Strauss, Gerald J. Bradley and Karl J. Smith, 3rd Edition, 2002.

**15MAT201 DISCRETE MATHEMATICS 3 1 0 4**

**Unit 1**

Logic, Mathematical Reasoning and Counting: Logic, Propositional Equivalence, Predicate and Quantifiers, Theorem Proving, Functions, Mathematical Induction. Recursive Definitions, Recursive Algorithms, Basics of Counting, Pigeonhole Principle, Permutation and Combinations. (Sections: 1.1 -1.3, 1.5 -1.7, 2.3, 4.1 - 4.4, 5.1 - 5.3 and 5.5)

**Unit 2**

Relations and Their Properties: Representing Relations, Closure of Relations, Partial Ordering, Equivalence Relations and partitions. (Sections: 7.1, 7.3 - 7.6)

Advanced Counting Techniques and Relations: Recurrence Relations, Solving Recurrence Relations, Generating Functions, Solutions of Homogeneous Recurrence Relations, Divide and Conquer Relations, Inclusion-Exclusion. (Sections: 6.1 - 6.6)

**Unit 3**

Graph Theory: Introduction to Graphs, Graph Operations, Graph and Matrices, Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path Problem, Planar Graph, Graph Colorings and Chromatic Polynomials. (Sections: 8.1 - 8.8)

**TEXTBOOK:**

Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw- Hill Publishing Company Limited, New Delhi, Sixth Edition, 2007.

**REFERENCES:**

1. R.P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, Fifth Edition, 2007.
2. Thomas Koshy, "Discrete Mathematics with Applications", Academic Press, 2005.
3. Liu, "Elements of Discrete Mathematics", Tata McGraw Hill Publishing Company Limited, 2004.

**15MAT213 PROBABILITY AND RANDOM PROCESSES 3 1 0 4****Unit 1**

Review of probability concepts - conditional probability - Bayes theorem.

Random Variable and Distributions: Introduction to random variable – discrete and continuous random variables and its distribution functions - mathematical expectations – moment generating function and characteristic function - Binomial, Poisson, Geometric, Uniform, Exponential, Normal distribution functions (moment generating function, mean, variance and simple problems) – Chebyshev's theorem.

**Unit 2**

Random processes: General concepts and definitions - stationarity in random processes - strict sense and wide sense stationary processes - autocorrelation and properties - special processes – Poisson points, Poisson and Gaussian processes and properties.

**Unit 3**

Systems with stochastic inputs - power spectrum- spectrum estimation, ergodicity –Markov process and Markov chain, transition probabilities, Chapman Kolmogrov theorem, limiting distributions classification of states.

**TEXTBOOKS:**

1. Douglas C. Montgomery and George C. Runger, *Applied Statistics and Probability for Engineers*, (2005) John Wiley and Sons Inc.
2. A. Papoulis, and Unnikrishna Pillai, *Probability, Random Variables and Stochastic Processes*, Fourth Edition, McGraw Hill, 2002.

**REFERENCE BOOKS:**

1. J. Ravichandran, *Probability and Random Processes for Engineers*, First Edition, IK International, 2015.
2. Scott L. Miller, Donald G. Childers, *Probability and Random Processes*, Academic press, 2012.

**15MAT301 LINEAR ALGEBRA, QUEUEING THEORY AND OPTIMIZATION 3 1 0 4****Unit 1**

Introduction to Linear Algebra: Review of matrices and linear systems of equations.

Vector spaces and subspaces, linear independence, basis and dimensions, linear transformations, orthogonality, Orthogonal basis, Gram Schmidt Process, least-square applications.

**Unit 2**

Queueing Theory: Introduction to Queuing Models, Characteristics of Queuing Models, Single Channel Queuing Theory, Solution to Single Channel Queuing Models, Application of Queuing Theory.

**Unit 3**

Single Variable Optimization Techniques: Single variable optimization: Optimality criteria – bracketing methods – region elimination methods – point estimation method – gradient based methods.

**TEXTBOOKS:**

1. Howard Anton and Chris Rorrs, *Elementary Linear Algebra*, Ninth Edition, John Wiley & Sons, 2000.
2. Kalyanmoy Deb, *Optimization for Engineering Design: Algorithms and Examples*, Prentice Hall, 2002.
3. *Operations Research - An Introduction*, A H, Taha Macmillan Publishing Co.

**15MEC100 ENGINEERING DRAWING - CAD 2 0 2 3**

Introduction, Drawing Instruments and their uses, Layout of the Software, standard tool bar/menus, navigational tools. Co-ordinate system and reference planes. Creation of 2 dimensional environment. Selection of drawing size and scale. Commands and Dimensioning.

Orthographic Projections: Introduction, Planes of projection, reference line. Projection of points in all the four quadrants. Projection of straight lines, Projection of Plane Surfaces, and Projection of Solids in first angle projection system.

**TEXTBOOK:**

Bhat N. D. and Panchal V. M, *Engineering Drawing Plane and Solid Geometry*, 42e, Charoatar Publishing House, 2010

**REFERENCES:**

1. James D. Bethune, *Engineering Graphics with AutoCAD*, Pearson Education, 2014
2. K. R. Gopalakrishna, *Engineering Drawing*, 2014, Subhas Publications
3. Narayan K. L. and Kannaiah P, *Engineering Drawing*, SciTech Publications, 2003

**15MEC180 WORKSHOP A 0 0 2 1****1. Product Detailing Workshop**

Disassemble the product of sub assembly - Measure various dimensions using measuring instruments - Free hand rough sketch of the assembly and components - Name of the components and indicate the various materials used - Study the



**Unit 2**

Central field problem

Two body central force problem, reduction to the equivalent one body problem, Kepler problem, inverse square law of force, motion in time in Kepler's problem, scattering in central force field, transformation of the scattering to laboratory system, Rutherford scattering, the three body problem.

Rotational kinematics and dynamics

Kinematics of rigid body motion, orthogonal transformation, Euler's theorem on the motion of a rigid body.

**Unit 3**

Angular momentum and kinetic energy of motion about a point, Euler equations of motion, force free motion of rigid body.

Practical rigid body problems

Heavy symmetrical spinning top, satellite dynamics, torque-free motion, stability of torque-free motion - dual-spin spacecraft, satellite maneuvering and attitude control - coning maneuver - Yo-yo despin mechanism - gyroscopic attitude control, gravity-gradient stabilization.

**TEXTBOOKS:**

1. H. Goldstein, *Classical Mechanics*, Narosa Publishing House, New Delhi, 1980, (Second Edition)
2. H. Goldstein, Charles Poole, John Safko, *Classical Mechanics*, Pearson education, 2002 (Third Edition)
3. Howard D. Curtis, *Orbital Mechanics for Engineering Students*, Elsevier, pp.475 - 543
4. Anderson John D, *Modern Compressible flow*, McGraw Hill.

**REFERENCE BOOKS:**

1. D. A. Walls, *Lagrangian Mechanics*, Schaum Series, McGraw Hill, 1967.
2. J. B. Marion and S. T. Thornton, *Classical dynamics of particles and systems*, Ft. Worth, TX: Saunders, 1995.

**15PHY233****BIOPHYSICS AND BIOMATERIALS****3 0 0 3**

**OBJECTIVE:** To equip the students with the knowledge on different kinds of biomaterials and other medical need, basic research, and to provide an over view of theory and practice of bio materials.

**Unit 1**

Quantum mechanics – Schrodinger's time dependent and independent equations – Pauli's exclusion principle – ionization energy – electron affinity – chemical binding – electro negativity and strong bonds - secondary bonds – inter atomic potential

for strong bonds and weak bonds – bond energies – spring constants – free energy – internal energy – reaction kinetics.

Definition and classification of bio-materials, mechanical properties, visco-elasticity, wound-healing process, Application of biomaterial for the human body, body response to implants, blood compatibility. Implementation problems - inflammation, rejection, corrosion, structural failure. Surface modifications for improved compatibility.

**Unit 2**

Bioceramics, Biopolymers, Metals, ceramics and composites in medicine: Properties, applications, suitability & modifications required for certain applications.

X-ray diffraction and molecular structure – Nuclear Magnetic Resonance – scanning tunneling microscope – Atomic force microscopy – optical tweezers – patch clamping – molecular dynamics – potential energy contour tracing – SEM – TEM – spectroscopy methods differential thermal analysis, differential thermo gravimetric analysis – NDT methods.

**Unit 3**

Materials for bone and joint replacement – dental metals and alloys – ceramic – bioinert – bioactive ceramics – polymers - dental restorative materials – dental amalgams – cardiovascular materials – cardiac prosthesis; vascular graft materials – cardiac pacemakers – cardiac assist devices – materials for ophthalmology contact lens – intraocular materials – materials for drug delivery.

**TEXTBOOKS AND REFERENCES:**

1. Rodney M J Cotterill, *Biophysics an introduction*, John Wiley & sons Ltd., NY, 2002
2. Vasantha Pattabhi and N.Gautham, *Biophysics*, Alpha science International Ltd. UK, 2002.
3. Jonathan Black, *Biological Performance of Materials, Fundamentals of Biocompatibility*, Marcel Dekker Inc., New York, 1992.
4. D. F. Williams (ed.), *Material Science and Technology - A comprehensive treatment*, Vol.14, *Medical and Dental Materials*, VCH Publishers Inc., New York, 1992.
5. H. H. Willard, L. L. Merritt, J. A. Dean and F. A. Settle, *Instrumental Methods of Analysis*, CBS Publishers, New Delhi, 1986.

**15PHY234 INTRODUCTION TO COMPUTATIONAL PHYSICS****3 0 0 3****Unit 1**

Differentiation: Numerical methods, forward difference and central difference methods, Lagrange's interpolation method.

Integration: Newton - cotes expression for integral, trapezoidal rule, Simpsons's rule, Gauss quadrature method.

**Unit 2**

Solution of differential equations: Taylor series method, Euler method, Runge Kutta method, predictor-corrector method.

Roots of equations: Polynomial equations, graphical methods, bisectional method, Newton-Raphson method, false position method.

**Unit 3**

Solution of simultaneous equations: Elimination method for solving simultaneous linear equations, Gauss elimination method, pivotal condensation method, Gauss-Seidel iteration method, Gauss Jordan method, matrix inversion method.

Eigen values and Eigen vectors of matrix: Determinant of a matrix, characteristic equation of a matrix, eigen values and eigen vectors of a matrix, power method.

**TEXTBOOK:**

Rubin H Landau & Manuel Jose Paez Mejia, "Computational Physics", John Wiley & Sons

**REFERENCES:**

Suresh Chandra, "Computer Applications in Physics", Narosa Publishing House, New Delhi  
M Hijroth Jensen, Department of Physics, University of Oslo, 2003 (Available in the Web)

**15PHY238 ELECTRICAL ENGINEERING MATERIALS 3 0 0 3****Unit 1**

Conducting materials: The nature of chemical bond, crystal structure Ohm's law and the relaxation time, collision time, electron scattering and resistivity of metals, heat developed in a current carrying conductor, thermal conductivity of metals, superconductivity.

Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and its consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

**Unit 2**

Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti-ferromagnetic materials, ferrites and its applications.

**Unit 3**

Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

PN junction: Drift currents and diffusion currents, continuity equation for minority carriers, quantitative treatment of the p-n junction rectifier, the n-p-n transistor.

**TEXTBOOK:**

A J Decker, "Electrical Engineering materials", PHI, New Delhi, 1957.

**REFERENCES:**

1. A J Decker, "Solid State Physics", Prentice Hall, Englewood Cliffs, N J 1957.
2. C Kittel, "Introduction to solid state Physics", Wiley, New York, 1956 (2nd edition).
3. Allison, "Electronic Engineering materials and Devices", Tata McGraw Hill
4. F K Richtmyer E H Kennard, John N Copper, "Modern Physics", Tata McGraw Hill, 1995 (5th edition).

**15PHY239 ELECTROMAGNETIC FIELDS AND WAVES 3 0 0 3****Unit 1**

Electrostatics: Coulombs law and electric field intensity, field due to a continuous volume charge distribution, field of a line charge, field of sheet of charge, electric flux density, Gauss's law, application of Gauss's law, Maxwell's first equation.

Poisson's and Laplace's equations: The potential field of a point charge, potential field of a system of charges: conservative property, potential gradient, the dipole.

**Unit 2**

Poisson's and Laplace's equations, uniqueness theorem, examples of the solution of Laplace's equation, solution of Poisson's equation.

Electromagnetics: Biot Savart law, magnetic flux and magnetic flux density, scalar and vector magnetic potentials, derivation of steady magnetic field laws, Faraday's laws, displacement current, Maxwell's equations in point and integral form, retarded potentials

**Unit 3**

Electromagnetic waves: EM wave motion in free space, wave motion in perfect dielectrics, plane wave in lossy dielectrics, Poynting vector and power consideration, skin effect, reflection of uniform plane waves, standing wave ratio.

Transmission line equations, line parameters - examples, dipole radiation, retarded potentials, electric dipole radiation.

**TEXTBOOK:**

William H Hayt, "Engineering Electromagnetics", Tata McGraw Hill, New Delhi, 2002 (5th edition).

**REFERENCES:**

1. David J Griffiths, "Introduction to Electrodynamics", Prentice-Hall of India, New Delhi, 1999 (2nd edition).

2. J D Jackson, "Classical Electrodynamics", Wiley Eastern, 2004 (2nd edition).
3. B. Chakraborty, "Principles of Electrodynamics", Books and Allied Publishers, 2002

**15PHY240 ELECTRONIC MATERIAL SCIENCES 3 0 0 3****Unit 1**

Types of bonding in solids, Crystallography and crystalline defects: Crystallography, Directions and planes, Crystalline defects, line defects, Planar defects, Volume defects; Binary and Ternary Phase Diagrams: Lever rule and phase rule, Eutectic, peritectic and Eutectoid systems, Applications of Phase diagrams; Basic Quantum Physics - atomic structure, Use of band theory and occupation statistics to explain existence and basic properties of metals and nonmetals. Working of Semiconductor Devices using band diagrams and their electrical characteristics: pn junctions, BJT, MOSFET.

**Unit 2**

Use of band theory to explain optoelectronic properties of materials and optoelectronic devices: LEDs, Solar Cells, Lasers, pin diodes, photodiodes; Magnetic properties and Superconductivity: Magnetic moments and Magnetic Permeability, types of magnetism, saturation magnetization, magnetic domains, soft and hard magnetic materials, superconductivity and its origin, Giant Magneto Resistance, Josephson effect, Energy band diagrams and Magnetism, Applications of magnetic materials - Magnetic recording materials, etc.

**Unit 3**

Optical Properties of Materials: Reflection, Refraction, Dispersion, Refractive Index, Snells Law, Light Absorption and Emission, Light Scattering, Luminescence, Polarization, Anisotropy, Birefringence; Dielectric Properties of Materials: Polarization and Permittivity, Mechanisms of polarization, dielectric properties - dielectric constant, dielectric loss, dielectric strength and breakdown, Piezoelectricity, Ferroelectricity, and Pyroelectricity, Dielectric Materials

**TEXTBOOK:**

S. O. Kasap, *Principles of Electronic Materials and Devices*, 2006, 3rd edition, Tata McGraw Hill.

**REFERENCE:**

D. Jiles: *Introduction to the Electronic Properties of Materials*, Chapman & Hall. 1994.

**15PHY241 LASERS IN MATERIAL PROCESSING 3 0 0 3****Unit 1**

Basic optical theory: Nature of electromagnetic radiation, interaction of radiation with matter, reflection, refraction, polarization, laser fundamentals, laser beam

characteristics, beam quality (laser cavity modes), Q-switching, mode locking, continuous wave, types of lasers, energy and power.

Laser interaction with materials: Optical properties of materials, laser interaction with metals, insulators, semiconductors, polymers and biological materials.

Laser surface treatment: Introduction to laser surface hardening, laser surface melting, laser surface alloying, laser surface cladding, laser cleaning. Laser ablation: mechanisms (photothermal, photophysical and photochemical), mask projection techniques, laser micro and nano structuring.

**Unit 2**

Laser cutting and drilling: Mechanism for inert gas and oxygen-assisted cutting, factors controlling cut quality and kerf width. Laser assisted drilling.

Laser welding: Introduction to laser keyhole welding and contrast with conduction limited welding, applications,

Direct laser fabrication (DLF): Laser sintering & laser rapid manufacturing, comparison with rapid prototyping. Main potential and limitations of DLF for direct fabrication and for the production of novel engineering materials and structures.

**Unit 3**

Laser forming: Mechanisms involved, including thermal temperature gradient, buckling, upsetting. Applications in alignment and straightening and in rapid production processes.

Scope of application of laser materials processing: focused on industrial application of laser in materials processing including laser welded tailored blanks.

Laser safety: Introduction to safety procedures in the use of lasers, including wavelength effects and laser safety standards.

**REFERENCES:**

1. Steen, W M, *Laser Material Processing (3rd Edition)*, Springer Verlag, 2003, ISBN 1852336986.
2. Silvest, W T, *Laser Fundamentals*, Cambridge University Press, 1998, ISBN 0521556171.
3. J. F. Ready, D. F. Farson. *LIA Handbook of Laser Materials Processing Laser Institute of America*, 2001.
4. M. von Allmen. *Laser-Beam Interactions with Materials*, Springer, 1987
5. D. Bauerle. *Laser Processing and Chemistry*, Springer, 2000
6. W. W. Duley, *UV lasers: effects and applications in materials science*, Cambridge University, Press, Cambridge; New York, 1996.

7. J. Dutta Majumdar, and I. Manna, *Laser Material Processing, Sadhana, Vol. 28, Year: 2003, 495-562.*

**15PHY243 MICROELECTRONIC FABRICATION 3 0 0 3**

**Unit 1**

Introduction to semiconductor fabrication – scaling trends of semiconductor devices; crystal structure of semiconductor materials, crystal defects, phase diagrams and solid solubility; physics of Czochralski growth of single crystal silicon, Bridgeman method for GaAs, float zone process; diffusion science: Ficks laws of diffusion, atomistic models of diffusion, dopant diffusion mechanisms; kinetics of thermal oxidation, Deal-Grove Model, nitridation of silicon, structure and characteristics of oxides, effect of dopants on oxidation kinetics, dopant redistribution;

**Unit 2**

Physics of ion implantation: Coulombic scattering and projected range, nuclear and electronic stopping, channeling, implantation damage removal, dopant activation by rapid thermal annealing; principles of optical lithography – optics and diffraction, light sources and spatial coherence, physics of pattern transfer, modulation transfer function; chemistry of lithographic processes: organic and polymeric photoresists, developing and exposure, contrast; principles of non-optical lithography: electron beam, X-ray lithography, resists, sources; etching: Chemistry of wet etching, plasma physics, chemistry of plasma etching and reactive ion etching; chemical mechanical polishing.

**Unit 3**

Vacuum science: Kinetic theory of gases, gas flow and conductance, vacuum pumps and seals; deposition of thin films: physics of sputtering and evaporation, step coverage and morphology of deposited films, chemical vapor deposition: chemical equilibrium and law of mass action, gas flow and boundary layers, types of CVD, plasma assisted CVD; thermodynamics of epitaxial growth, types molecular beam epitaxy, isolation and contact formation – LOCOS and trench, silicides, metallization with Al and Cu; process Integration: CMOS, bipolar process flow.

**TEXTBOOK:**

*Stephen Campbell, Science and Engineering of Microelectronic Fabrication, Oxford University Press, 2001*

**REFERENCE:**

1. S K Gandhi, *VLSI Fabrication Principles, John Wiley & Sons, 1994*
2. Gary S May and Simon M Sze, *Fundamentals of Semiconductor Fabrication, John Wiley, 2003.*
3. S Wolfe, *Silicon Processing for the VLSI Era, Lattice Press, 1998.*

**15PHY245 NUCLEAR ENERGY: PRINCIPLES AND APPLICATIONS 3 0 0 3**

**Unit 1**

Basics: Atomic theory, nuclear composition, sizes and masses of nuclei, binding energy, radioactive decay, radioactive chains. Nuclear reactions, transmutation of elements, conservation laws, neutron cross sections, interaction of charged particles and gamma radiation with matter.

Fission and fusion: The fission process, energetic of fission, byproducts of fission, energy from nuclear fuels. Fusion reactions, electrostatic and nuclear forces, thermo nuclear reactions in plasma. Energetics of fusion. Comparison of fusion and fission reactions.

**Unit 2**

Neutron chain reactions and nuclear power: Criticality and multiplication, factors governing the multiplication, neutron flux and reactor power, reactor types and reactor operations. Methods of heat transmission and removal, steam generation and electric power generation, waste heat disposal.

**Unit 3**

Breeder reactors and fusion reactors: The concept of breeding nuclear fuel, isotope production and consumption, fast breeder reactor, breeding and uranium sources. Technical problems in the functioning of fusion reactor, requirements for practical fusion reactors, magnetic confinement, inertial confinements and other fusion concepts. Prospects of fusion power.

Radiation protection and waste disposal: Biological effects of radiation, radiation dose units, protective measures, internal exposure, and radon problem. Nuclear fuel cycle and waste classification, spent fuel storage and transportation, high level waste disposal, low level waste disposal.

**TEXTBOOK:**

*Raymond L Murray, Nuclear Energy: An Introduction to the Concepts, Systems and Applications of Nuclear Processes, Butterworth-Heimann-Elsevier Inc (2009)*

**REFERENCES:**

1. David Bodansky, *Nuclear Energy: principles, practices and prospects, Springer Verlag*
2. S K Rajput, *Nuclear Energy, Mahaveer & Sons (2009)*

**15PHY247 PHOTOVOLTAICS 3 0 0 3**

**Unit 1**

Introduction to semiconductors: Semiconductors: concept of electron and holes, conduction in semiconductors and concentration of charge carriers in



semiconductors. Direct and indirect band gap semiconductors (quantum mechanical treatment). Extrinsic semiconductors: n-type, p-type & compensation doping, carrier concentration; PN junction - concept of bands at PN junction, junction under forward and reverse biases (conceptual).

### Unit 2

Optical Processes: Optical absorption, Photoelectric Effect, Beer-Lambert law (Qualitative). Wavelength to band gap relation. Generation of electron-hole pairs. Recombination processes - direct and indirect recombination, other recombination processes - Shockley Reed Hall recombination, Auger recombination.

Solar Cell – Principle: Introduction & history of Solar cells. Constituents of solar radiations (Solar Spectrum). Separation of electrons and holes. Transport of charge carriers - diffusion & drift of carriers, continuity equation, field current, diffusion current, total charge current.

### Unit 3

Solar Cell – Properties: Measurement of solar cell parameters - short circuit current, open circuit voltage, fill factor, efficiency. Optical losses, electrical losses, surface recombination velocity, quantum efficiency - external and internal, I-V characteristics of Solar cells. Fabrication and design of Solar cells. Performance enhance: Enhance absorption, Reduce series resistance, surface recombination.

Advanced Solar cell technologies (III Generation): Alternatives to conventional Si based solar cells - Thin film solar cells, Hetero junction solar cells, Tandem solar cells: material properties, fabrication and stability (includes nano scale devices). Organic solar cells.

#### TEXTBOOK:

Wenham SR, "Applied Photovoltaics", 2nd ed., Earthscan Publications Ltd., (2007).

#### REFERENCES:

1. Peter Würfel, "Physics of Solar Cells", 2nd Ed., Wiley VCH (2005).
2. S O Kasap, "Principles of Electronic Materials and Devices", McGraw-Hill, New York (2005).

## 15PHY248 PHYSICS OF LASERS AND APPLICATIONS 3 0 0 3

### Unit 1

Review of some basic concepts and principle of laser.

Introduction to light and its properties: Reflection, refraction, interference, diffraction and polarization. Photometry – calculation of solid angle. Brewster's law. Snell's law and, its analysis.

Introduction to LASERS: Interaction of radiation with matter - induced absorption, spontaneous emission, stimulated emission. Einstein's co-efficient (derivation). Active material. Population inversion – concept and discussion about different techniques. Resonant cavity.

### Unit 2

Properties of LASERS

Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of  $\Delta\omega$  FWHM natural emission line width as deduced by quantum mechanics - additional broadening process: collision broadening, broadening due to dephasing collision, amorphous crystal broadening, Doppler broadening in laser and broadening in gases due to isotope shifts. Saturation intensity of laser, condition to attain saturation intensity.

Properties – coherency, intensity, directionality, monochromaticity and focussibility. LASER transition – role of electrons in LASER transition, levels of LASER action: 2 level, 3 level and 4 level laser system.

### Unit 3

Types of LASERS

Solid state LASER: (i) Ruby LASER – principle, construction, working and application. (ii) Neodymium (Nd) LASERS. gas LASER: (i) He-Ne LASER - principle, construction, working and application. (i) CO<sub>2</sub> LASER - principle, construction, working and application.

Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homo-junction and hetero-junction LASERS, high power semi conductor diode LASERS.

Applications in Communication field:

LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication.

Applications of LASERS in other fields:

Holography: Principle, types, intensity distribution, applications. laser induced fusion. Harmonic generation. LASER spectroscopy. LASERS in industry: Drilling, cutting and welding. Lasers in medicine: Dermatology, cardiology, dentistry and ophthalmology.

#### REFERENCES:

1. William T Silfvast, "Laser Fundamentals", Cambridge University Press, UK (2003).
2. B B Laud, "Lasers and Non linear Optics", New Age International (P) Ltd., New Delhi.

3. Andrews, "An Introduction to Laser Spectroscopy (2e)", Ane Books India (Distributors).
4. K R Nambiar, "Lasers: Principles, Types and Applications", New Age International (P) Ltd., New Delhi.
5. T Suhara, "Semiconductor Laser Fundamentals", Marcel Dekker (2004).

**15PHY250 QUANTUM PHYSICS AND APPLICATIONS 3 0 0 3**

**Unit 1**

Review of Planck's relation, De-Broglie relation and uncertainty principle basic concepts - Schrodinger equation: probabilistic interpretation of wave function, one dimension problems – particle in a box, harmonic oscillator, potential barrier and tunneling. Hydrogen atom, electrons in a magnetic field - X-ray spectra - periodic table.

**Unit 2**

Bosons and Fermions - symmetric and antisymmetric wavefunctions - elements of statistical physics: density of states, fermi energy, Bose condensation - solid state physics: Free electron model of metals, elementary discussion of band theory and applications to semiconductor devices.

Einstein coefficients and light amplification - stimulated emission - optical pumping and laser action.

**Unit 3**

Operation of He-Ne laser and Ruby laser - laser in science and Industry - Raman effect and applications.

Nuclear physics: nuclear properties - binding energy and mass formula - nuclear decay with applications - theory of alpha decay - nuclear forces – fission - principle of nuclear reactor - elementary particles - leptons, hadrons, quarks, field bosons - the standard model of elementary particles.

**TEXTBOOK:**

A Beiser, *Perspectives in Modern Physics*, McGraw Hill

**REFERENCES;**

1. Arthur Beiser, *Concepts of Modern Physics*, 6th Edition Tata McGraw Hill
2. S H Patil, *Elements of Modern Physics*, Tata McGraw Hill, 1989
3. K Krane, *Modern Physics*, John Wiley, 1998.
4. K Thyagarajan, A K Ghatak, *Lasers-Theory and Applications*, Macmillan, 1991

**15PHY251 THIN FILM PHYSICS 3 0 0 3**

**Unit 1**

Introduction and preparation of thin film: Difference between thin and thick film. Appreciation of thin film technology in modern era. Deposition technology: Physical methods, chemical methods, other new techniques, vacuum technology: Vacuum pumps & pressure gauges.

Defects in thin film: General concepts, nature of defect, microscopic defect and dislocation. Boundary defects. Defect and energy states - donor acceptor levels, trap and recombination centers, excitons, phonons.

**Unit 2**

Thin film analysis: Structural studies: XRD and electron diffraction. Surface studies: electron microscopy studies on film (SEM, TEM, AFM) Film composition: X-ray photoelectron spectroscopy (XPS), Rutherford Back Scattering spectroscopy (RBS) and Secondary Ion Mass Spectroscopy (SIMS).

Properties of thin film: Optical behaviors: transmission, reflection, refractive index, photoconductivity, and photoluminescence.

**Unit 3**

Electrical behaviors: sheet resistivity, electron mobility and concentration, Hall effect, conduction in MIS structure.

Mechanical behaviors: stress, adhesion, hardness, stiffness.

Applications of thin films in various fields: Antireflection coating, FET, TFT, resistor, thermistor, capacitor, solar cell, and MEMs fabrication of silicon wafer: Introduction. preparation of the silicon wafer media, silicon wafer processing steps.

**TEXTBOOK:**

K. L. Chopra, "Thin Film Phenomena", McGraw Hill, New York, 1969

**REFERENCES:**

1. L. T. Meissel and R. Glang, "Hand book of thin film technology", McGraw Hill, 1978.
1. A. Goswami, "Thin Film Fundamentals", New Age International, Pvt Ltd, New Delhi, 1996.
2. O. S. Heavens "optical Properties of Thin Films" by, Dover Publications, Newyork 1991.
3. Milton Ohring "Materials science of thin films deposition and structures", Academic press, 2006.
4. Donald L. Smith "Thin Film deposition principle and Practice", McGraw Hill international Edition, 1995.

**15PHY331****ASTRONOMY****3 0 0 3****Unit 1**

Astronomy, an Observational Science: Introduction - Indian and Western Astronomy – Aryabhata - Tycho Brahe's observations of the heavens - The laws of planetary motion - Measuring the astronomical unit - Isaac Newton and his Universal Law of Gravity - Derivation of Kepler's third law - The Sun - The formation of the solar system- Overall properties of the Sun - The Sun's total energy output - Black body radiation and the sun's surface temperature - The Fraunhofer lines in the solar spectrum and the composition of the sun - Nuclear fusion - The proton–proton cycle - The solar neutrino problem - The solar atmosphere: photosphere, chromosphere and corona - Corionium - The solar wind- The sunspot cycle - Solar The Planets - Planetary orbits - Orbital inclination - Secondary atmospheres - The evolution of the earth's atmosphere.

**Unit 2**

Observational Astronomy

Observing the Universe - The classic Newtonian telescope - The Cassegrain telescope - Catadioptric telescopes - The Schmidt camera - The Schmidt–Cassegrain telescope - The Maksutov–Cassegrain telescope - Active and adaptive optics - Some significant optical telescopes - Gemini North and South telescopes - The Keck telescopes - The South Africa Large Telescope (SALT) - The Very Large Telescope (VLT) - The Hubble Space Telescope (HST) - The future of optical astronomy - Radio telescopes - The feed and low noise amplifier system - Radio receivers - Telescope designs - Large fixed dishes - Telescope arrays - Very Long Baseline Interferometry (VLBI) - The future of radio astronomy - Observing in other wavebands – Infrared – Sub-millimetre wavelengths - The Spitzer space telescope - Ultraviolet, X-ray and gamma-ray observatories - Observing the universe without using electromagnetic radiation - Cosmic rays - Gravitational waves.

**Unit 3**

The Properties of Stars: Stellar luminosity - Stellar distances - The hydrogen spectrum - Spectral types - Spectroscopic parallax - The Hertzsprung–Russell Diagram - The main sequence - The giant region - The white dwarf region - The stellar mass – luminosity relationship - Stellar lifetimes - Stellar Evolution – White dwarfs - The evolution of a sun-like star - Evolution in close binary systems – Neutron stars and black holes - The discovery of pulsars - Black holes: The Milky Way - Open star clusters - Globular clusters - Size, shape and structure of the Milky Way – observations of the hydrogen line - Other galaxies - Elliptical galaxies - Spiral galaxies - The Hubble classification of galaxies - The universe - The Cepheid variable distance scale - Starburst galaxies - Active galaxies - Groups and clusters of galaxies – Superclusters - The structure of the universe -

Cosmology – the Origin and Evolution of the Universe - The expansion of the universe - The cosmic microwave background - The hidden universe: dark matter and dark energy - The Drake equation - The Search for Extra Terrestrial Intelligence (SETI) - The future of the universe.

**TEXTBOOK:**

*Introduction to Astronomy and Cosmology, Ian Morison, Wiley (UK), 2008*

**REFERENCE BOOK:**

*Astronomy: Principles and Practice, 4th Edition (Paperback), D. C. Clarke, A. E. RoylInstitute of Physics Publishing*

**15PHY333****CONCEPTS OF NANOPHYSICS AND NANOTECHNOLOGY****3 0 0 3****Unit 1**

Introduction

Introduction to nanotechnology, comparison of bulk and nanomaterials – change in band gap and large surface to volume ratio, classification of nanostructured materials. Synthesis of nanomaterials - classification of fabrication methods – top down and bottom up methods.

Concept of quantum confinement and phonon confinement

Basic concepts – excitons, effective mass, free electron theory and its features, band structure of solids. Bulk to nanotransition – density of states, potential well - quantum confinement effect – weak and strong confinement regime. Electron confinement in infinitely deep square well, confinement in two and three dimension. Blue shift of band gap - effective mass approximation. Vibrational properties of solids - phonon confinement effect and presence of surface modes.

**Unit 2**

Tools for characterization:

Structural – X-ray diffraction, transmission electron microscope, scanning tunneling microscope, atomic force microscope. Optical - UV – visible absorption and photoluminescence techniques, Raman spectroscopy.

Nanoscale materials – properties and applications:

Carbon nanostructures – structure, electrical, vibration and mechanical properties. Applications of carbon nanotubes

**Unit 3**

Field emission and shielding – computers – fuel cells – chemical sensors – catalysis – mechanical reinforcement. Quantum dots and Magnetic nanomaterials – applications.

Nanoelectronics and nanodevices:

Impact of nanotechnology on conventional electronics. Nanoelectromechanical systems (NEMSs) – fabrication (lithography) and applications. Nanodevices - resonant tunneling diode, quantum cascade lasers, single electron transistors – operating principles and applications.

**TEXTBOOKS:**

1. Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan, *Nanoscale Science and Technology*, John Wiley and Sons Ltd 2004.
2. W. R. Fahrner (Ed.), *Nanotechnology and Nanoelectronics*, Springer 2006.

**15PHY335**

**MEDICAL PHYSICS**

**3 0 0 3**

**Unit 1**

Ultrasonics - production methods and properties - acoustic impedance - Doppler velocimetry - echo cardiography – resolution – speckle - ultrasound imaging - therapeutic use of ultrasound - use in diagnostics of cardiac problems.

X-rays – production – intensity - hard and soft X-rays - characteristic and continuous X-ray spectrum - attenuation of x-rays by hard and soft tissues – resolution – contrast X-ray imaging - fluoroscopy modes of operation - image quality - fluoroscopy suites - radiation dose – computed-aided tomography (CAT).

**Unit 2**

Nuclear medicine - principles of nuclear physics – natural radioactivity, decay series, type of radiation and their applications, artificially produced isotopes and its application, accelerator principles; Nuclear Isomerism, internal conversion - ideal energy for radiotherapy based on interactions. Radionuclide used in medicine - radioisotope production – dosimetry – safety - radiation hazards – PET.

Nuclear magnetic resonance physics - magnetic moment – magnetization – relaxation - nuclear magnetic resonance spectroscopy.

**Unit 3**

Nuclear magnetic resonance imaging (MRI) – principle - chemical shift - magnetic resonance signal induction and relaxation - pulse sequencing and spatial encoding.

Laser physics – characteristics of laser radiation, mode locking - power of laser radiation - lasers as diagnostic tool - lasers in surgery - laser speckle, biological effects, laser safety management.

**TEXTBOOK:**

Hendee W R and Rittenour E E, *“Medical Imaging Physics”*, John Wiley & Sons, Chicago, 2001.

**REFERENCE BOOKS**

1. Glasser. O. *Medical Physics Vol.1, 2, 3 Book Publisher Inc Chicago, 1980*
2. Jerraold T Bush Berg et al, *The essentials physics of medical imaging*, Lippincott Williams and Wilkins (2002)

**15PHY338**

**PHYSICS OF SEMICONDUCTOR DEVICES**

**3 0 0 3**

**Unit 1**

Introduction: Unit cell, Bravais lattices, crystal systems, crystal planes and Miller indices, symmetry elements. Defects and imperfections – point defects, line defects, surface defects and volume defects.

Electrical conductivity: Classical free electron theory – assumptions, drift velocity, mobility and conductivity, drawbacks. quantum free electron theory – Fermi energy, Fermi factor, carrier concentration. Band theory of solids – origin of energy bands, effective mass, distinction between metals, insulators and semiconductors.

**Unit 2**

Theory of semiconductors: Intrinsic and extrinsic semiconductors, band structure of semiconductors, carrier concentration in intrinsic and extrinsic semiconductors, electrical conductivity and conduction mechanism in semiconductors, Fermi level in intrinsic and extrinsic semiconductors and its dependence on temperature and carrier concentration. Carrier generation - recombination, mobility, drift-diffusion current. Hall effect.

Theory of p-n junctions – diode and transistor: p-n junction under thermal equilibrium, forward bias, reverse bias, carrier density, current, electric field, barrier potential. V-I characteristics, junction capacitance and voltage breakdown.

**Unit 3**

Bipolar junction transistor, p-n-p and n-p-n transistors: principle and modes of operation, current relations. V-I characteristics. Fundamentals of MOSFET, JFET. Heterojunctions – quantum wells.

Semiconducting devices: Optical devices: optical absorption in a semiconductor, e-hole generation. Solar cells – p-n junction, conversion efficiency, heterojunction solar cells. Photo detectors – photo conductors, photodiode, p-i-n diode. Light emitting diode (LED) – generation of light, internal and external quantum efficiency.

Modern semiconducting devices: CCD - introduction to nano devices, fundamentals of tunneling devices, design considerations, physics of tunneling devices.

**TEXTBOOKS:**

1. C Kittel, *“Introduction to Solid State Physics”*, Wiley, 7th Edn., 1995.

2. D A Neamen, "Semiconductor Physics and Devices", TMH, 3rd Edn., 2007.

**REFERENCES:**

1. S M Sze, "Physics of Semiconductor Devices", Wiley, 1996.
2. P Bhattacharya, "Semiconductor Opto- Electronic Devices", Prentice Hall, 1996.
3. M K Achuthan & K N Bhat, "Fundamentals of Semiconductor Devices", TMH, 2007.
4. J Allison, "Electronic Engineering Materials and Devices", TMH, 1990.

**15PHY532****ASTROPHYSICS****3 0 0 3****Unit 1**

Historical introduction: Old Indian and western – astronomy - Aryabhata, Tycho Brahe, Copernicus, Galileo - Olbers paradox - solar system – satellites, planets, comets, meteorites, asteroids.

Practical astronomy - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.

Celestial mechanics - Kepler's laws - and derivations from Newton's laws.

Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

**Unit 2**

Stellar astronomy: H-R diagram, color- magnitude diagram - main sequence - stellar evolution – red giants, white dwarfs, neutron stars, black holes - accretion disc - Schwarzschild radius - stellar masses Saha – Boltzman equation - derivation and interpretation.

Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds - Nebulae.

**Unit 3**

Galactic astronomy: Distance measurement - red shifts and Hubble's law – age of the universe, galaxies – morphology - Hubble's classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.

Relativity: Special theory of relativity - super-luminal velocity - Minkowski space - introduction to general theory of relativity – space - time metric, geodesics, space-time curvature. Advance of perihelion of Mercury, gravitational lens.

Cosmology: Cosmic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - plank length and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.

**REFERENCES:**

1. "Textbook of Astronomy and Astrophysics with elements of Cosmology", V. B. Bhatia, Narosa publishing 2001.
2. William Marshall Smart, Robin Michael Green "On Spherical Astronomy", (Editor) Carroll, Bradley W Cambridge University Press ,1977
3. Bradley W. Carroll and Dale A. Ostlie. "Introduction to modern Astrophysics" Addison-Wesley, 1996.
4. Bradley W. Carroll and Dale A. Ostlie, "An Introduction to Modern Astrophysics" Addison-Wesley Publishing Company, 1996
5. 'Stellar Astronomy' by K. D Abhayankar.
6. 'Solar Physics' by K. D Abhayankar.

**15PHY535****EARTH'S ATMOSPHERE****3 0 0 3****Unit 1**

Earth's atmosphere: overview and vertical structure. Warming the earth and the atmosphere: temperature and heat transfer; absorption, emission, and equilibrium; incoming solar energy. Air temperature: daily variations, controls, data, human comfort, measurement. Humidity, condensation, and clouds: circulation of water in the atmosphere; evaporation, condensation, and saturation; dew and frost; fog.

**Unit 2**

Cloud development and precipitation: atmospheric stability & determining stability, cloud development and stability, precipitation processes, collision and coalescence, precipitation types, measuring precipitation. Air pressure and winds: atmospheric pressure, pressure measurement, surface and upper-air charts, surface winds, winds and vertical air motions, measuring and determining winds. Atmospheric circulations: scales of atmospheric motion, eddies, local wind systems, global winds, global wind patterns and the oceans.

**Unit 3**

Air masses, fronts, and mid-latitude cyclones. Weather forecasting: acquisition of weather information, forecasting methods and tools, forecasting using surface charts. Thunderstorms: ordinary (air-mass) thunderstorms, mesoscale convective complexes, floods and flash floods, distribution of thunderstorms, lightning and thunder. Tornadoes: severe weather and Doppler radar, waterspouts.

**Unit 4**

Hurricanes (cyclones, typhoons): tropical weather; anatomy, formation, dissipation and naming of hurricanes. Air pollution: a brief history, types and sources, factors that affect air pollution, the urban environment, acid deposition. Global climate: climatic classification; global pattern of climate.

**Unit 5**

Climate change: possible causes; carbon dioxide, the greenhouse effect, and recent global warming. Light, colour, and atmospheric optics: white and colours, white clouds and scattered light; blue skies and hazy days, red suns and blue moons; twinkling, twilight, and the green flash; the mirage; halos, sundogs, and sun pillars; rainbows; coronas and cloud iridescence.

**TEXTBOOK:**

C. Donald Ahrens: *Essentials of Meteorology: An Invitation to the Atmosphere (6th edition)*, Brooks-Cole, 2010.

**REFERENCE:**

Frederick K. Lutgens & Edward J. Tarbuck: *The Atmosphere, An Introduction to Meteorology (11th Edition)*, Prentice Hall, 19 January, 2009

**15PHY536 EARTH'S STRUCTURE AND EVOLUTION 3 0 0 3****Unit 1**

Introduction: geologic time; earth as a system, the rock cycle, early evolution, internal structure & face of earth, dynamic earth. Matter and minerals: atoms, isotopes and radioactive decay; physical properties & groups of minerals; silicates, important nonsilicate minerals, resources. Igneous rocks: magma, igneous processes, compositions & textures; naming igneous rocks; origin and evolution of magma, intrusive igneous activity, mineral resources and igneous processes.

**Unit 2**

Volcanoes and volcanic hazards: materials extruded, structures and eruptive styles, composite cones and other volcanic landforms, plate tectonics and volcanic activity. Weathering and soils: earth's external processes; mechanical & chemical weathering, rates; soils, controls of formation, profile, classification, human impact, erosion, weathering and ore deposits. Sedimentary rocks: the importance and origins of sedimentary rocks; detrital & chemical sedimentary rocks, coal, converting sediment into sedimentary rock; classification & structures, nonmetallic mineral & energy resources. Metamorphism and metamorphic rocks: metamorphic textures, common metamorphic rocks, metamorphic environments & zones.

**Unit 3**

Mass wasting: gravity, mass-wasting and landform development, controls and triggers, classification of mass-wasting processes, slump, rockslide, debris flow, earthflow, slow movements. Running water: hydrologic cycle, running water, streamflow, work of running water, stream channels, base level and graded streams, shaping stream valleys, depositional landforms, drainage patterns, floods and flood control. Groundwater: importance and distribution, water table, factors influencing storage and movement, springs, wells, artesian wells, environmental problems, hot springs and geysers, geothermal energy, geologic work. Glaciers

and glaciation: formation and movement, erosion & landforms, deposits, other effects, causes. Deserts and wind: distribution and causes, geologic processes, basin and range, wind transport, erosion & deposits.

**Unit 4**

Shorelines: coastal zone, waves & erosion, sand movement, shoreline features & stabilization; erosion problems along U.S. coasts, hurricanes, coastal classification, tides. Earthquakes and earth's interior: faults, seismology, locating the source of an earthquake, measuring intensity, belts and plate boundaries, destruction, damage east of the Rocky Mountains, earthquake prediction, earth's interior. Plate tectonics: continental drift, divergent boundaries, convergent boundaries, transform fault boundaries, testing the plate tectonics model, the breakup of Pangaea, measuring plate motion, what drives plate motions, plate tectonics in the future.

**Unit 5**

Origin and evolution of the ocean floor: continental margins, features of deep-ocean basins, anatomy of oceanic ridge, oceanic ridges and seafloor spreading, nature of oceanic crust, continental rifting, destruction of oceanic lithosphere. Crustal deformation and mountain building: structures formed by ductile & brittle deformation, mountain building at subduction zones, collisional mountain belts, fault-block mountains, vertical movements of the crust. Geologic time: time scales, relative dating, correlation of rock layers; dating with radioactivity, the geologic time scale, difficulties in dating. Earth's evolution: birth of a planet, origin of the atmosphere and oceans, Precambrian (formation of continents); Phanerozoic (formation of modern continents & earth's first life); Paleozoic (life explodes); the Mesozoic (dinosaurs); Cenozoic era (mammals). Global climate change: climate & geology, climate system, detecting change; atmospheric basics & heating the atmosphere; natural & human causes; carbon dioxide, trace gases, and climate change; climate-feedback mechanisms, aerosols, some possible consequences.

**TEXTBOOK:**

Frederick K. Lutgens, Edward J. Tarbuck & Dennis G. Tasa: *Essentials of Geology (11th edition)*, Prentice Hall, 8 March, 2012.

**REFERENCE:**

Graham R. Thompson & Jonathan Turk: *Introduction to Physical Geology (2nd Edition)*, Brooks Cole, 23 June, 1997.

**15PHY540 NONLINEAR DYNAMICS 3 0 0 3****Unit 1**

Introduction: examples of dynamical systems, driven damped pendulum, ball on oscillating floor, dripping faucet, chaotic electrical circuits. One-dimensional maps: the logistic map, bifurcations in the logistic map, fixed points and their stability, other one-dimensional maps.

Non-chaotic multidimensional flows: the logistic differential equation, driven damped harmonic oscillator, Van der Pol equation, numerical solution of differential equations.

Dynamical systems theory: two-dimensional equilibrium and their stability, saddle points, are contraction and expansion, non-chaotic three-dimensional attractors, stability of two-dimensional maps, chaotic dissipative flows.

### Unit 2

Lyapunov exponents: for one- and two-dimensional maps and flows, for three-dimensional flows, numerical calculation of largest Lyapunov exponent, Lyapunov exponent spectrum and general characteristics, Kaplan-Yorke dimension, numerical precautions.

Strange attractors: general properties, examples, search methods, probability of chaos and statistical properties of chaos, visualization methods, basins of attraction, structural stability.

Bifurcations: in one-dimensional maps and flows, Hopf bifurcations, homoclinic and heteroclinic bifurcations, crises.

Hamiltonian chaos: Hamilton's equations and properties of Hamiltonian systems, examples, three-dimensional conservative flows, symplectic maps.

### Unit 3

Time-series properties: examples, conventional linear methods, a case study, time-delay embeddings.

Nonlinear prediction and noise-reduction: linear predictors, state-space prediction, noise reduction, Lyapunov exponents from experimental data, false nearest neighbours.

Fractals: Cantor sets, curves, trees, gaskets, sponges, landscapes.

Calculations of fractal dimension: similarity, capacity and correlation dimensions, entropy, BDS statistic, minimum mutual information, practical considerations.

Fractal measure and multifractals: convergence of the correlation dimension, multifractals, examples and numerical calculation of generalized dimensions.

Non-chaotic fractal sets: affine transformations, iterated functions systems, Mandelbrot and Julia sets.

Spatiotemporal chaos and complexity: examples, cellular automata, coupled map lattices, self-organized criticality.

### TEXTBOOK:

Hilborn, R. C., *Chaos and Nonlinear Dynamics, Second Edition, Oxford University Press, 2000*

### REFERENCES:

1. Sprott, J. C., *Chaos and Time Series Analysis, Oxford University Press, 2003*
2. Strogatz, S. H., *Nonlinear Dynamics and Chaos, Westview Press, 2001*
3. Solari, H. G., Natiello, M. A., and Mindlin, G. B., *Nonlinear Dynamics, Overseas Press (India) Private Limited, 2005*

## 15PHY542

## OPTOELECTRONIC DEVICES

3 0 0 3

### Unit 1

Properties of semiconductors: Electron and photon distribution: density of states, effective mass and band structure, effect of temperature and pressure on band gap, recombination processes.

Basics of semiconductor optics: Dual nature of light, band structure of various semiconductors, light absorption and emission, photoluminescence. electroluminescence, radioactive and non-radiative recombination, wave trains.

### Unit 2

Semiconductor light-emitting diodes: Structure and types of LEDs and their characteristics, guided waves and optical modes, optical gain, confinement factor, internal and external efficiency, semiconductor heterojunctions, double-heterostructure LEDs.

Semiconductor lasers: Spontaneous and stimulated emission, principles of a laser diode, threshold current, effect of temperature, design of an edge-emitting diode, emission spectrum of a laser diode, quantum wells, quantum-well laser diodes.

### Unit 3

Semiconductor light modulators: Modulating light (direct modulation of laser diodes, electro-optic modulation, acousto-optic modulation), isolating light (magneto-optic isolators), inducing optical nonlinearity (frequency conversion, switching)

Semiconductor light detectors: I-V characteristics of a p-n diode under illumination, photovoltaic and photoconductive modes, load line, photocells and photodiodes, p-i-n photodiodes, responsivity, noise and sensitivity, photodiode materials, electric circuits with photodiodes, solar cells.

### REFERENCES:

1. *Semiconductor Optoelectronics: Physics and Technology, Jasprit Singh, McGraw Hill Companies, ISBN 0070576378*
2. *Optoelectronics, E. Rosencher and B. Vinter, Cambridge Univ. Press, ISBN 052177813.*

3. Photonic Devices, J. Liu, Cambridge Univ. Press, ISBN 0521551951.
4. Semiconductor Optoelectronic Devices 2nd Edition", P. Bhattacharya, Prentice Hall, ISBN 0134956567.
5. Physics of Semiconductor Devices, by S. M. Size (2nd Edition, Wiley, New York, 1981).

**15SAN101 SANSKRIT I 1 0 2 2**

**OBJECTIVES:** To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

**Unit 1**

Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit. Practical classes in spoken Sanskrit

**Unit 2**

Verbs - Singular, Dual and plural – First person, Second person, Third person.

Tenses – Past, Present and Future – Atmanepadi and Parasmaipadi-karthariprayoga

**Unit 3**

Words for communication, slokas, moral stories, subhashithas, riddles (from the books prescribed)

**Unit 4**

Selected slokas from Valmiki Ramayana, Kalidasa's works and Bhagavad Gita.

Ramayana – chapter VIII - verse 5, Mahabharata - chapter 174, verse -16, Bhagavad Gita – chapter - IV verse 8, Kalidasa's Sakuntalam Act IV – verse 4

**Unit 5**

Translation of simple sentences from Sanskrit to English and vice versa.

**ESSENTIAL READING:**

1. Praveshaha; Publisher: Samskrita bharti, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore - 560 085
2. Sanskrit Reader I, II and III, R. S. Vadyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalinganusasanam by Amarasimha published by Travancore Sanskrit series
7. Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nirnayasagar press

**15SAN111 SANSKRIT II 1 0 2 2**

**OBJECTIVES:** To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

**Unit 1**

Seven cases, indeclinables, sentence making with indeclinables, Saptha karakas.

**Unit 2**

Ktavatu Pratyaya, Upasargas, Ktvanta, Tumunnanta, Lyabanta.

Three Lakaras – brief introduction, Lot lakara.

**Unit 3**

Words and sentences for advanced communication. Slokas, moral stories (Pancatantra) Subhashitas, riddles.

**Unit 4**

Introduction to classical literature, classification of Kavyas, classification of Dramas - The five Mahakavyas, selected slokas from devotional kavyas - Bhagavad Gita – chapter - II verse 47, chapter - IV verse 7, chapter - VI verse 5, chapter - VIII verse 6, chapter - XVI verse 21, Kalidasa's Sakuntala act IV – verse 4, Isavasyopanishat 1st Mantra, Mahabharata chapter 149 verses 14 - 120, Neetisara chapter - III

**Unit 5**

Translation of paragraphs from Sanskrit to English and vice versa.

**ESSENTIAL READING:**

1. Praveshaha; Publisher: Samskrita bharti, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085
2. Sanskrit Reader I, II and III, R.S. Vadyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalinganusasanam by Amarasimha published by Travancore Sanskrit series
7. Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nirnayasagar Press.

**15SSK221 SOFT SKILLS I 1 0 2 2**

Soft skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. Need for change. Fears, stress and competition



in the professional world. Importance of positive attitude, self motivation and continuous knowledge upgradation.

Self-confidence: Characteristics of the person perceived, characteristics of the situation, characteristics of the perceiver. Attitude, values, motivation, emotion management, steps to like yourself, positive mental attitude, assertiveness.

Presentations: Preparations, outlining, hints for efficient practice, last minute tasks, means of effective presentation, language, gestures, posture, facial expressions, professional attire.

Vocabulary building: A brief introduction into the methods and practices of learning vocabulary. Learning how to face questions on antonyms, synonyms, spelling error, analogy, etc. Faulty comparison, wrong form of words and confused words like understanding the nuances of spelling changes and wrong use of words. Listening skills: The importance of listening in communication and how to listen actively.

Prepositions, articles and punctuation: A experiential method of learning the uses of articles and prepositions in sentences is provided.

Problem solving level I: Number system; LCM &HCF; Divisibility test; Surds and indices; Logarithms; Ratio, proportions and variations; Partnership;

Problem solving level II: Time speed and distance; work time problems;

Data interpretation: Numerical data tables; Line graphs; Bar charts and Pie charts; Caselet forms; Mix diagrams; Geometrical diagrams and other forms of data representation.

Logical reasoning: Family tree; Deductions; Logical connectives; Binary logic; Linear arrangements; Circular and complex arrangement; Conditionalities and grouping; Sequencing and scheduling; Selections; Networks; Codes; Cubes; Venn diagram in logical reasoning; Quant based reasoning; Flaw detection; Puzzles; Cryptogtrhms.

#### TEXTBOOKS:

1. *A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.*
2. *Adair. J., (1986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.*
3. *Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.*
4. *The Hard Truth about Soft Skills, by Amazone Publication.*
5. *Quantitative Aptitude by R. S. Aggarwal, S. Chand*
6. *Quantitative Aptitude – Abijith Guha, TMH.*
7. *Quantitative Aptitude for Cat - Arun Sharma. TMH.*

#### REFERENCES:

1. *Books on GRE by publishers like R. S. Aggrawal, Barrons, Kaplan, The Big Book, and Nova.*
2. *More Games Teams Play, by Leslie Bendaly, McGraw Hill Ryerson.*
3. *The BBC and British Council online resources*
4. *Owl Purdue University online teaching resources*  
*www.the grammarbook.com - online teaching resources*  
*www.englishpage.com- online teaching resources and other useful websites.*

### 15SSK321

### SOFT SKILLS II

1 0 2 2

Professional grooming and practices: Basics of corporate culture, key pillars of business etiquette. Basics of etiquette: Etiquette – socially acceptable ways of behaviour, personal hygiene, professional attire, cultural adaptability. Introductions and greetings: Rules of the handshake, earning respect, business manners. Telephone etiquette: activities during the conversation, conclude the call, to take a message. Body Language: Components, undesirable body language, desirable body language. Adapting to corporate life: Dealing with people.

Group discussions: Advantages of group discussions, structured GD – roles, negative roles to be avoided, personality traits to do well in a GD, initiation techniques, how to perform in a group discussion, summarization techniques.

Listening comprehension advanced: Exercise on improving listening skills, grammar basics: Topics like clauses, punctuation, capitalization, number agreement, pronouns, tenses etc.

Reading comprehension advanced: A course on how to approach middle level reading comprehension passages.

Problem solving level III: Money related problems; Mixtures; Symbol based problems; Clocks and calendars; Simple, linear, quadratic and polynomial equations; special equations; Inequalities; Functions and graphs; Sequence and series; Set theory; Permutations and combinations; Probability; Statistics.

Data sufficiency: Concepts and problem solving.

Non-verbal reasoning and simple engineering aptitude: Mirror image; Water image; Paper folding; Paper cutting; Grouping of figures; Figure formation and analysis; Completion of incomplete pattern; Figure matrix; Miscellaneous.

Spacial aptitude: Cloth, leather, 2D and 3D objects, coin, match sticks, stubs, chalk, chess board, land and geodesic problems etc., related problems.

**TEXTBOOKS:**

1. *A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.*
2. Adair. J., (1986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
3. Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
4. *The Hard Truth about Soft Skills, by Amazone Publication.*
5. *Quick Maths – Tyra.*
6. *Quicker Arithmetic – Ashish Aggarwal*
7. *Test of reasoning for competitive examinations by Thorpe.E. TMH*
8. *Non-verbal reasoning by R. S. Aggarwal, S. Chand*

**REFERENCES:**

1. *Books on GRE by publishers like R. S. Aggarwal, Barrons, Kaplan, The Big Book, and Nova*
2. *More Games Teams Play, by Leslie Bendaly, McGraw Hill Ryerson.*
3. *The BBC and British Council online resources*
4. *Owl Purdue University online teaching resources*  
[www.thegrammarbook.com](http://www.thegrammarbook.com) - online teaching resources  
[www.englishpage.com](http://www.englishpage.com) - online teaching resources and other useful websites.

**15SSK331****SOFT SKILLS III****1 0 2 2**

Team work: Value of team work in organisations, definition of a team, why team, elements of leadership, disadvantages of a team, stages of team formation. Group development activities: Orientation, internal problem solving, growth and productivity, evaluation and control. Effective team building: Basics of team building, teamwork parameters, roles, empowerment, communication, effective team working, team effectiveness criteria, common characteristics of effective teams, factors affecting team effectiveness, personal characteristics of members, team structure, team process, team outcomes.

Facing an interview: Foundation in core subject, industry orientation/knowledge about the company, professional personality, communication skills, activities before interview, upon entering interview room, during the interview and at the end. Mock interviews.

Advanced grammar: Topics like parallel construction, dangling modifiers, active and passive voices, etc.

Syllogisms, critical reasoning: A course on verbal reasoning. Listening comprehension advanced: An exercise on improving listening skills.

Reading comprehension advanced: A course on how to approach advanced level of reading, comprehension passages. Exercises on competitive exam questions.

Problem solving level IV: Geometry; Trigonometry; Heights and distances; Co-ordinate geometry; Mensuration.

Specific training: Solving campus recruitment papers, national level and state level competitive examination papers; Speed mathematics; Tackling aptitude problems asked in interview; Techniques to remember (In mathematics). Lateral thinking problems. Quick checking of answers techniques; Techniques on elimination of options, estimating and predicting correct answer; Time management in aptitude tests; Test taking strategies.

**TEXTBOOKS:**

1. *A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.*
2. Adair. J., (1986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
3. Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
4. *The Hard Truth about Soft Skills, by Amazone Publication.*
5. *Data Interpretation by R. S. Aggarwal, S. Chand*
6. *Logical Reasoning and Data Interpretation – Niskit K Sinkha*
7. *Puzzles – Shakuntala Devi*
8. *Puzzles – George J. Summers.*

**REFERENCES:**

1. *Books on GRE by publishers like R. S. Aggarwal, Barrons, Kaplan, The Big Book, and Nova.*
2. *More Games Teams Play, by Leslie Bendaly, McGraw-Hill Ryerson.*
3. *The BBC and British Council online resources*
4. *Owl Purdue University online teaching resources*  
[www.thegrammarbook.com](http://www.thegrammarbook.com) - online teaching resources  
[www.englishpage.com](http://www.englishpage.com) - online teaching resources and other useful websites.

**15SWK230****CORPORATE SOCIAL RESPONSIBILITY****2 0 0 2****Unit 1**

Understanding CSR - Evolution, importance, relevance and justification. CSR in the Indian context, corporate strategy. CSR and Indian corporate. Structure of CSR - In the Companies Act 2013 (Section 135); Rules under Section 13; CSR activities, CSR committees, CSR policy, CSR expenditure CSR reporting.

**Unit 2**

CSR Practices & Policies - CSR practices in domestic and international area; Role and contributions of voluntary organizations to CSR initiatives. Policies; Preparation of CSR policy and process of policy formulation; Government expectations, roles and responsibilities. Role of implementation agency in Section 135 of the Companies Act, 2013. Effective CSR implementation.

**Unit 3**

Project Management in CSR initiatives - Project and programme; Monitoring and evaluation of CSR Interventions. Reporting - CSR Documentation and report writing. Reporting framework, format and procedure.

**REFERENCES:**

1. *Corporate Governance, Ethics and Social Responsibility*, V Bala Chandran and V Chandrasekaran, PHI Learning Private Limited, New Delhi 2011.
2. White H. (2005) *Challenges in evaluating development effectiveness: Working paper 242*, Institute of Development Studies, Brighton.
3. UNDP (nd) *Governance indicators: A users guide*. Oslo: UNDP
4. Rao, Subbha (1996) *Essentials of Human Resource Management and Industrial Relations*, Mumbai, Himalaya
5. Rao, V. S. L. (2009) *Human Resource Management*, New Delhi, Excel Books,

**15SWK231****WORKPLACE MENTAL HEALTH****2 0 0 2****Unit 1**

Mental Health – concepts, definition, Bio-psycho-social model of mental health. Mental health and mental illness, characteristics of a mentally healthy individual, Signs and symptoms of mental health issues, presentation of a mentally ill person. Work place – definition, concept, prevalence of mental health issues in the work place, why invest in workplace mental health, relationship between mental health and productivity, organizational culture and mental health. Case Study, Activity.

**Unit 2**

Mental Health Issues in the Workplace: Emotions, Common emotions at the workplace, Mental Health issues - Anger, Anxiety, Stress & Burnout, Depression, Addictions – Substance and Behavioural, Psychotic Disorders - Schizophrenia, Bipolar Disorder, Personality disorders. Crisis Situations - Suicidal behavior, panic attacks, reactions to traumatic events. Stigma and exclusion of affected employees. Other issues –work-life balance, Presenteeism, Harassment, Bullying, Mobbing. Mental Health First Aid - Meaning. Case Study, Activity.

**Unit 3**

Strategies of Help and Care: Positive impact of work on health, Characteristics of mentally healthy workplace, Employee and employer obligations, Promoting mental health and well being- corporate social responsibility (CSR), an inclusive work environment, Training and awareness raising, managing performance, inclusive recruitment, Supporting individuals-talking about mental health, making reasonable adjustments, Resources and support for employees - Employee Assistance Programme / Provider (EAP), in house counsellor, medical practitioners, online resources and telephone support, 24 hour crisis support, assistance for colleagues and care givers, Legislations. Case Study, Activity.

**REFERENCES:**

1. American Psychiatric Association. "Diagnostic and statistical manual of mental disorders: DSM - IV 4th ed." [www.terapiacognitiva.eu/dwl/dsm5/DSM-IV.pdf](http://www.terapiacognitiva.eu/dwl/dsm5/DSM-IV.pdf)
2. American Psychiatric Association. (2000) [www.ccsa.ca/Eng/KnowledgeCentre/OurDatabases/Glossary/Pages/index.aspx](http://www.ccsa.ca/Eng/KnowledgeCentre/OurDatabases/Glossary/Pages/index.aspx).
3. Canadian Mental Health Association, Ontario "Workplace mental health promotion, A how to guide"[wmhp.cmhaontario.ca/](http://wmhp.cmhaontario.ca/)
4. Alberta Health Services Mental Health Promotion. (2012). *Minding the Workplace: Tips for employees and managers together*. Calgary: Alberta Health Services.<http://www.mentalhealthpromotion.net/resources/minding-the-workplace-tips-for-employees-and-managers-together.pdf>
5. Government of Western Australia, Mental Health Commission. (2014) "Supporting good mental health in the work place." [http://www.mentalhealth.wa.gov.au/Libraries/pdf\\_docs/supporting\\_good\\_mental\\_health\\_in\\_the\\_workplace\\_1.sflb.ashx](http://www.mentalhealth.wa.gov.au/Libraries/pdf_docs/supporting_good_mental_health_in_the_workplace_1.sflb.ashx)
6. Mental Health Act 1987 (India) [www.tnhealth.org/mha.htm](http://www.tnhealth.org/mha.htm)
7. Persons with disabilities Act 1995 (India) [socialjustice.nic.in](http://socialjustice.nic.in)
8. The Factories Act 1948 (India) [www.caaa.in/Image/19ulabourlawshb.pdf](http://www.caaa.in/Image/19ulabourlawshb.pdf)

**15TAM101****TAMIL I****2 0 0 2**

**Objectives :** To introduce the students to different literature - Sangam literature, Epics, Bhakthi literature and modern literature. To improve their ability to communicate with creative concepts, and also to introduce them to the usefulness of basic grammatical components in Tamil.

**Unit 1**

Sangam literature : Kuruntokai; (2, 6,8,40 pāṭalkaḷ) – purānānūru (74,112,184,192 pāṭalkaḷ) – tirukkuraḷ (iraṁmāṭci, amaiccu)

**Unit 2**

Epic literature: cilappatikāram maturaik kāṇṭam (vaḷakkuraikkātai 50-55)  
Spiritual Literature: tiruppāvai(3,4) – tēvāram (mācivīṇaiyumu)  
Medieval Literature: bāratīyar kaṇṇaṇ pāṭṭu (eṇ vīlaiyāṭṭu piḷḷai) – bāratitacaṇ kuṭumpavilakku (tāyiṇ tālāṭṭu).

**Unit 3**

Novel: Jeyakāntaṇ "kuru piṭam"  
Essay: Aṇṇā "ē tāḷinta tamiḷakamē"

**Unit4**

Tirunāṇa campantar – tirunāvukkaracar – cuntarar – māṇikka vācakar – āṇṭā – tirumūlar – kulacēkara ālvār – cīttalaic cāttanār toṭarpāṇa ceytikal, mērkōḷkal marṛum ciṛappup peyarkaḷ

**Unit 5**

Tamil Grammar: Col vakaikal - vēṛṛumai urupukaḷ - valliṇam mikumiṭam mikāyiṭam - canti(puṇarcci) - ilakkaṇakkuṛippu.

Practical skills: Listening, speaking, writing and reading

**Textbooks:**

- *Aṇṇā “ē tāḷnta tamīlakamē” nakkīraṇ paplikēṣaṇs.*
- *Caktitācaṇ cupramaṇiyaṇ “nalla kuṭuntokai mūlamumuraiyum” mullai patippakam, 2008.*
- *http://www.Tamilvu.Org/libirary/libindex.Htm.*
- *Jeyakāntaṇ “kuru piṭam” mṇāṭci puttaka nīlayam, 1971.*
- *Nā.Pārttacārati “puṇāṇāṇṛuc ciṛukataikaḷ” tamīḷp puttakālayam, 1978, 2001*
- *Poṇ maṇimāṇṛaṇ “aṭōṇ tamīḷ ilakkaṇam “aṭōṇ papliṣiṇ kurūp, vaṇciyūr, tiruvaṇantapuram, 2007.*
- *puliyūrk kēcikaṇ “kuṭuntokai mūlamum uraiyum” cārāta patippakam, 2010.*
- *Puliyūrk kēcikaṇ “puṇāṇāṇṛu” srīceṇpakā patippakam, 2010*

**15TAM111****TAMIL I I****2 0 0 2**

**Objectives:** To learn the history of Tamil literature. To analyze different styles, language training, to strengthen the creativity in communication, Tamil basic grammar, Computer and its use in Tamil language.

**Unit 1**

The history of Tamil literature: Nāṭṭupuṇap pāṭalkaḷ, kataikkal, paḷamoliḷkaḷ - ciṛukataikaḷ tōṛṛamum vaḷarcciyum,

ciṛṛilakkiyaṇkaḷ: Kaliṇkattup paraṇi (pōrpāṭiyatu) - mukkūṭar paḷḷu 35.

Kāppiyaṇkaḷ: Cilappatikāram – maṇimēkalai naṭaiyiyal āyvu marṛum aimperum – aiṇciṛuṇ kāppiyaṇkaḷ toṭarpāṇa ceytikal.

**Unit 2**

tiṇai ilakkiyamum nīyilakkiyamum - patiṇṇēkīḷkkaṇakku nūlkaḷ toṭarpāṇa piṇa ceytikal - tirukkuṛaḷ (aṇṇu, paṇṇu, kalvi, oḷukkam, naṭṭu, vāymai, kēḷvi, ceynaṇṇi, periyāraittuṇakkōṭal, viḷippuṇarvu pēṇṇa atikāratil uḷḷa ceytikal.

Aṇṇūlkaḷ: Uḷakanīti (1-5) – ēlāti (1,3,6). - Cittarkaḷ: Kaṭuveḷi cittar pāṭalkaḷ (āṇantak kaḷippu –1,4,6,7,8), marṛum akappēy cittar pāṭalkaḷ(1-5).

**Unit 3**

tamiḷ ilakkaṇam: Vākkiya vakaikaḷ – taṇvīnai piṇaviṇai – nērkūrū ayarkūrū

**Unit 4**

tamiḷaka aṇṇākaḷiṇ tamīḷ toṇṭum camutāya toṇṭum: Pāratiyār, pāratitācaṇ, paḷṭukkōḷṭai kalyāṇacuntaram, curatā, cujātā, ciṛpi, mēttā, aptul rakumāṇ, na.Piccaimūrṭti, akilaṇ, kalki, jī.Yū.Pōp, vīramāmuṇivar, aṇṇā, paritimāṇ kalaiṇar, maḷaimalaiyaṭikaḷ.

**Unit 5**

tamiḷ molī āyvil kaṇiṇi payaṇpāṭu. - Karuttu parimāṛram - viḷampara moliyamaippu – pēccu - nāṭakam paṭaiṇṇu - ciṛukatai, katai, putiṇam paṭaiṇṇu.

**Textbooks:**

- *http://www.tamilvu.trg/libirary/libindex.htm.*
- *http://www.tunathamizh.com/2013/07/blog0post\_24.html*
- *Mu.Varatarācaṇ “tamīḷ ilakkiya varalāṇṛu” cāhīya akaṭemi paplikēṣaṇs, 2012*
- *nā.Vāṇamāmalai “paḷāṇkatakāḷum, paḷamoliḷkaḷum” niyū ceṇcuri puttaka vēḷiyiṭṭakam, 1980,2008*
- *nā.Vāṇamāmalai, “tamīḷar nāṭṭuppāṭalkaḷ” niyū ceṇcuri puttaka vēḷiyiṭṭakam 1964,2006*
- *poṇ maṇimāṇṛaṇ “aṭōṇ tamīḷ ilakkaṇam “aṭōṇ papliṣiṇ kurūp, vaṇciyūr, tiruvaṇantapuram, 2007.*